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J952-43

An Assessment of

Development and Production Potential of Federal Coal Leases

Volume II—Working Papers

Part C: Development and Production Potential of Existing Federal Coal Leases in the Fort Union Region of North Dakota and Montana

October 1982

CONGRESS OF THE UNITED STATES
Office of Technology Assessment
Washington, D. C. 20510

Preface

This volume contains papers written for OTA to assist in preparation of the report *An Assessment of Development and Production Potential of Federal Coal Leases.* OTA does not endorse these papers. In several instances, the OTA report reaches somewhat different conclusions because of additional information which was obtained later. These papers, however, may prove valuable for readers needing more detailed or specific information than could be accommodated in the final assessment report, and are being made available for such purposes.

OTA WORKING PAPER C

DEVELOPMENT AND PRODUCTION POTENTIAL OF EXISTING FEDERAL COAL LEASES IN THE FORT UNION REGION OF NORTH DAKOTA AND MONTANA

FINAL REPORT
prepared for
OFFICE OF TECHNOLOGY ASSESMENT
Congress of the United States
Washington, D.C. 20510

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August 1981

This report is an OTA working paper, which was used in the preparation of OTA's final report, An Assessment of the Development and Production Potential of Federal Coal Leases. OTA makes these papers available for the use of its readers desiring more detailed or technical information than could be accommodated in our final report. As an OTA working paper, this report has not been reviewed or approved by the Technology Assessment Board. The findings and conclusions expressed in the report are those of the authors and do not necessarily reflect the views of OTA, the coal leasing project advisory panel, or the Technology Assessment Board. In several instances, the OTA report reaches somewhat different conclusions than this Working Paper because of additional information that was received after the preparation of the Working Paper.

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INTRODUCTION

In 1976, Congress passed the Federal Coal Leasing Amendments Act. The purpose of this Act was to establish a more orderly procedure for the leasing and development of Federally owned coal. Toward this end, Section 10 of the Act directed the Congressional Office of Technology Assessment (OTA) to conduct a comprehensive analysis of all mining activities on existing federal coal leases in six western states. Further, OTA was directed to determine the present and potential value of these leases; to estimate the future revenue derived from these leases; and to assess the feasibility of using deep mining methods in leased areas.[1]

This report will focus only on the development prospects for existing federal leases in the Fort Union coal region.[*] The analysis is functionally divided into two sections. The first section, subdivided into four chapters, addresses a variety of issues that affect the level of mining activity in the region. Chapter I describes the geophysical characteristics of North Dakota lignite reserves, and their effect on current mining techniques and conditions. Chapter II, examines the existing and future markets for North Dakota lignite. Specifically, this chapter discusses the extent of planned market developments, identifies potential constraints to the implementation of these plans, and finally, assesses the actual market potential for North Dakota lignites.

Legal and institutional factors are addressed in Chapter III. This chapter discusses those state and federal environmental regulations that are

[*] The Fort Union coal region covers the western half of North Dakota and parts of eastern Montana and northwestern South Dakota.

applicable to North Dakota's lignite mining industry. Although environmental issues associated with mining are discussed in this section, no attempt is made to assess the degree to which mining and/or coal related activities may contribute to environmental degradation. Rather, the discussion focuses on the effects that enforcement of environmental regulations are likely to have on the expansion of mining activity. Chapter IV concerns infrastructural constraints to increased production of North Dakota lignite, such as transportation facilities, labor and community services.

Section Two examines the production potential for each of the leases within the context of the broader regional issues discussed in Section One. In this section, leases have been segregated into leases included in, or associated with, mine plans (including extended mine plans) submitted to the U.S. Office of Surface Mining (OSM) and those leases not included in pending or approved mine plans. The prospects for continued or future production, or the likelihood of development, are examined for each category respectively. Throughout the following discussion, leases included in mine plans will be referred to as "developed" while leases not included in mine plans will be designated as "undeveloped".

Chapter V presents the development prospects for the undeveloped leases, and also describes the methodology used to assess the potential for development. A rigid methodological approach was required to evaluate the prospects for production from these leases as data and other information concerning them is either difficult to obtain or nonexistent. Briefly, the methodology is three-tiered and involves the application of standardized criteria developed by OTA to specifically evaluate all the undeveloped coal leases examined in this assessment. There are two sets of criteria, or screens, which attempt roughly to quantify, on a lease specific basis, the various factors discussed in Chapters I through IV (for example, coal quality and environmental constraints). The third and final part of the analysis is a narrative discussion of the leases. This component provides a qualitative assessment of the factors unique to each lease--something which standardized criteria, by definition, cannot do. Chapter VI is the corollary assessment for the developed leases. This analysis was designed to determine the quantity of coal likely to be produced from developed federal leases between 1979 and 1991. Since these leases are associated with operating mines or included in mine plans, more detailed information was available concerning their respective production prospects than was identified for the undeveloped leases. It was therefore not necessary to use OTA's screening methodology to determine potential levels of future production. The developed lease assessment provides forecasts of production levels from Fort Union coal mines associated with Federal coal leases along with estimates of federal coal production. A site specific analysis, including a history of mining at the site along with a discussion of future prospects is presented for all the developed leases.

The 22 leases evaluated in this report are listed in Table 1 on the following page. The leases are organized by blocks in order to designate associations likely to occur during mine development. Blocks were defined using OTA criteria discussed in Chapter V. As shown on the table, 20 of the 22 Fort Union leases are located in western North Dakota (see Figure 1). Two are located in eastern Montana.[2]

TABLE 1 FORT UNION COAL REGION: LEASE LIST, ORGANIZED BY BLOCK

NORTH DAKOTA

Block #	Serial #	Owner/Mine Name	County	Dev.* Status	Acreage
1	M061025	Americal Colloid Co.	Williams	U	80
2	M043848	Baukol-Noonan, Inc./ Center Mine	Oliver	P	2,325
3	M21209	Consolidation Coal Co./ Glenharold Mine	Mercer	P	1,668
	M070203		Mercer&Oliver	A	477
	M11269		Oliver	A	160
					2,305
4	M37829	Consolidation Coal Co./ Renner's Cove	Mercer	U	322
5	M15896	Consolidation Coal Co./ Velva Mine	Ward	U	40
6	M042819	Coteau Properties Co./ Beulah-Hazen Mine	Mercer	U**	764
	M071813		Mercer	P	2,034
7	M163	Coteau Properties Co./ Beulah-Hazen Mine	Mercer	U	400
8	M31053	Falkirk Mining Co./ Falkirk Mine	McClean	P	160
9	M065329	Geo Resources Exploration Inc./Nelson Mine	Williams	U	320
10	BLM019127	Knife River Coal Mining Co./Gascoyne Mine	Bowman	A	2,872
11	M437	Knife River Coal Mining Co./New Leipzig	Hettinger&Grant	U	640
	M438			U	2,872
12	M041765	Knife River Coal Mining Co./South Beulah Mine	Mercer&Oliver	A	1,600
	M43083		Mercer	U**	80
13	BLM018322	Leroy Bonsness	Burke	U	80
14	BK020273	North American Coal Co./ Indian Head Mine	Mercer	A	1,357
	M34980		Mercer	A	441
					1,798

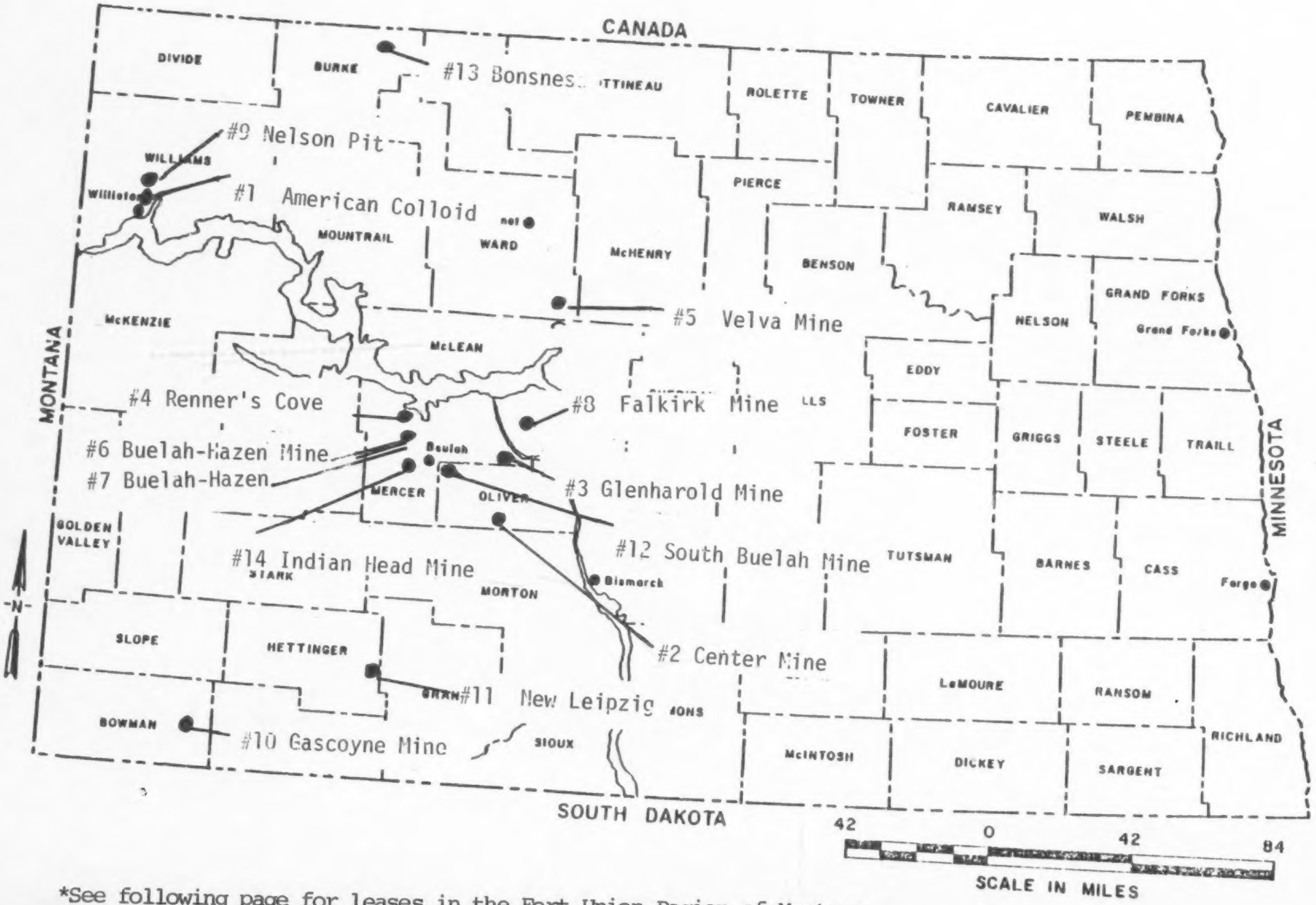
MONTANA

Block #	Serial #	Owner/Mine Name	County	Dev.* Status	Acreage
15	M3831	U.S. Steel Corporation	Dawson	U	2,537
	M3832		Dawson	U	2,559

---

*Developed Leases: A = Approved Mine Plan; P = Pending Mine Plan; U** = Associated with Leas in Mine Plans. Undeveloped Leases: U = Leases not included in Mine Plans.

Figure I Federal Mines and Lease Block Location in the Fort Union Coal Region of North Dakota*


CANADA
MONTANA
MINNESOTA
SOUTH DAKOTA
#13 Bonsnes
#9 Nelson Pit
#1 American Colloid
#5 Velva Mine
#4 Renner's Cove
#8 Falkirk Mine
#6 Buelah-Hazen Mine
#7 Buelah-Hazen
#3 Glenharold Mine
#12 South Buelah Mine
#14 Indian Head Mine
#2 Center Mine
#11 New Leipzig
#10 Gascoyne Mine
DIVIDE
BURKE
ROLETTE
TOWNER
CAVALIER
PEMBINA
WILLIAMS
Williston
PIERCE
RAMSEY
WALSH
MOUNTRAIL
WARD
McHENRY
BENSON
GRAND FORKS
Grand Forks
McKENZIE
McLEAN
NELSON
EDDY
FOSTER
GRIGGS
STEELE
TRAILL
Beulah
MERCER
OLIVER
GOLDEN VALLEY
STARK
MORTON
TUTSMAN
BARNES
CASS
Fargo
Bismarck
SLOPE
HETTINGER
LaMOURE
RANSOM
BOWMAN
SIOUX
McINTOSH
DICKEY
SARGENT
RICHLAND
N
42
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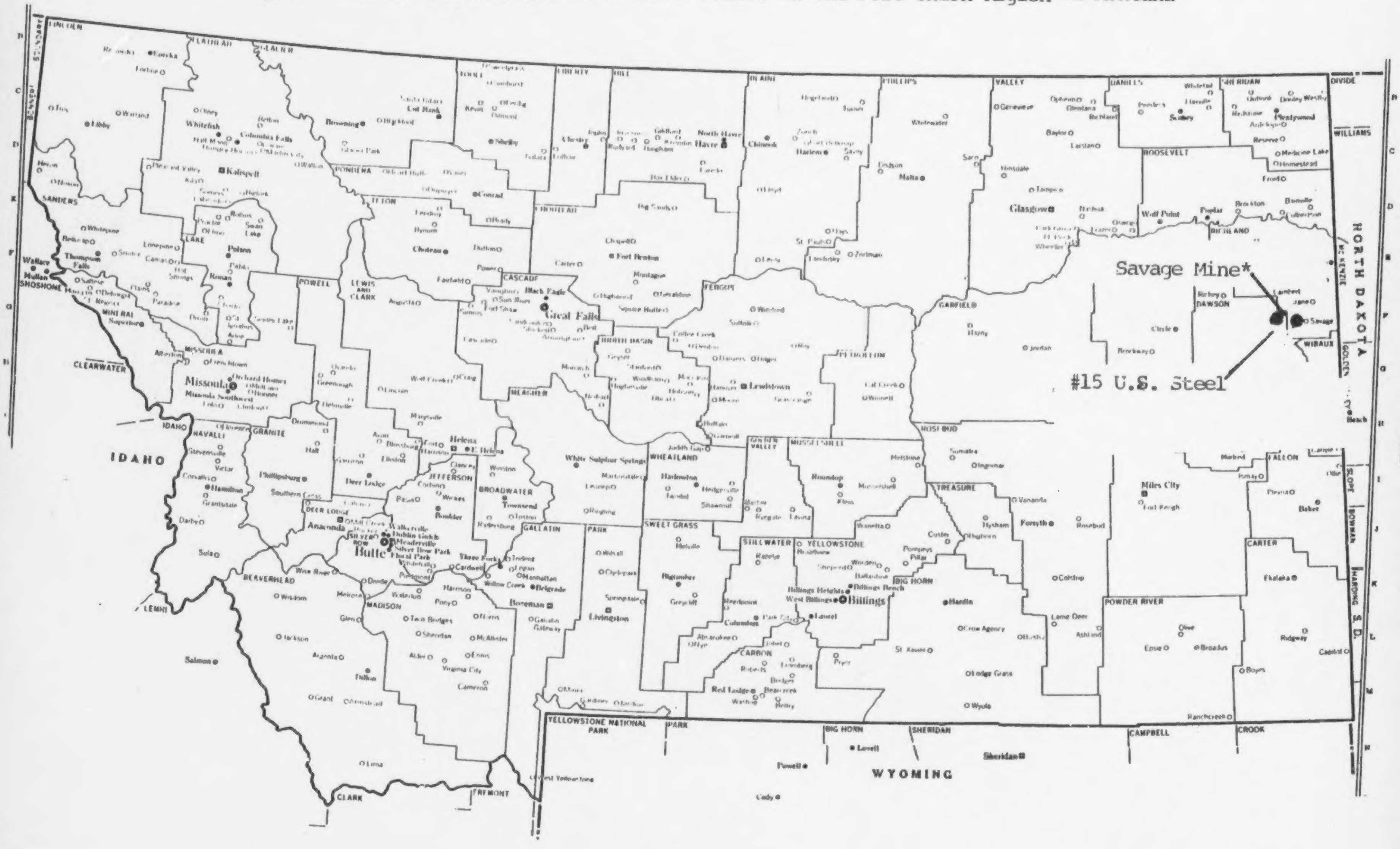
42
84
SCALE IN MILES

*See following page for leases in the Fort Union Region of Montana

Figure I (cont.) Federal Mines and Lease Blocks in the Fort Union Region of Montana


Savage Mine*
#15 U.S. Steel
NORTH DAKOTA
IDAHO
WYOMING
S.D.
Missoula
Great Falls
Helena
Butte
Billings
Lewistown
Havre
Glasgow
Miles City
Kalispell
Savage

* Knife River Coal Company's Savage Mine (one Federal lease with an approved mine plan) is addressed in another OTA contract report on developed leases in Montana and Wyoming

REFERENCES (Introduction)

1. U.S. General Accounting Office, Issues Facing the Future of Federal Coal Leasing, EMD 79-47 (Washington, D.C., June 25, 1979).

2. One of the three Fort Union Region Montana leases pictured on Figure 1 is not listed on Table 1 and will not be addressed in this report. This lease is associated with the Knife River Coal Mining Company's Savage Mine and is discussed in detail in another OTA regional assessment (Schmidt, Jack C., Sanna Porte, and Arnold J. Silverman, A Review of Current Production and Anticipated Future Production of Federal Lease Blocks in Montana and Wyoming, U.S. Congress, Office of Technology Assessment, December, 1980. The two Montana leases listed on Table 1 are examined on a site-specific basis in Chapter V of this report. In general, the discussions provided in Chapter I of this report (Overview of North Dakota Resources and Mining Techniques) pertain to the two Montana leases, but most of the issues presented in Chapters II through IV are applicable only to the 20 leases located in North Dakota. Reference is made to another OTA regional report (Boulding, J. Russell and Deborah Pederson, Development and Production Potential of Undeveloped Federal Coal Leases and Preference Right Lease Applications in the Powder River Basin and Other Wyoming Coal Basins, U.S. Congress, Office of Technology Assessment, November 1980, for a discussion of issues associated with the development of the two Montana leases.

SECTION ONE

ISSUE ANALYSIS

BACKGROUND

The coal field found in western North Dakota is part of the lignite bearing Fort Union coal region. Lignite was first used by Northern Plains Indians who pried the exposed coal from outcroppings and burned it as a source of fuel. Unable to locate abundant wood supplies, early settlers soon adopted lignite for heating and cooking. As the number of homesteaders grew, so did the demand for the plentiful fuel. Using only pick and shovel, the first commercial mine operator produced six tons of coal in his first year of operation, 1883. The lignite mining industry grew to 73 underground mines scattered across the western half of the state at the turn of the century. With the introduction of strip mining in 1919, the industry continued to grow until 1926, when the number of mines and miners reached their peak at 226 and 2,145, respectively. In 1945, surface mining became the dominant form of lignite extraction, but following World War II the industry lost its domestic heating market to cleaner burning fuels and declined. Production fell from almost four million tons in 1951 to 2.3 million tons in 1958.[1,2]

The construction of several coal-burning power plants in the early 1960's improved the prospects for renewed growth of the industry. By 1970, production had reached five million tons per year. A new generation of mine-mouth power plants connected by long distance transmission lines to electricity demand centers raised the annual demand for North Dakota lignite to over 15 million tons in 1980.[3]

Underlying the western half of North Dakota, the Fort Union lignite field extends into Canada, Montana and South Dakota. Over two-thirds of the nation's in-place reserves--more than 350 billion tons--are located in North

Dakota alone. Estimates place the state's strippable reserves at 16 billion tons. Despite the vast resource base, the growth of North Dakota's coal mining industry has been slow in comparison to its western neighbors Montana and Wyoming. Consequently, the Federal government has issued fewer leases in this state than any other major western coal producing state. Of the over 500 leases issued by the Bureau of land Management, only 20 are found in North Dakota.*[4,5]

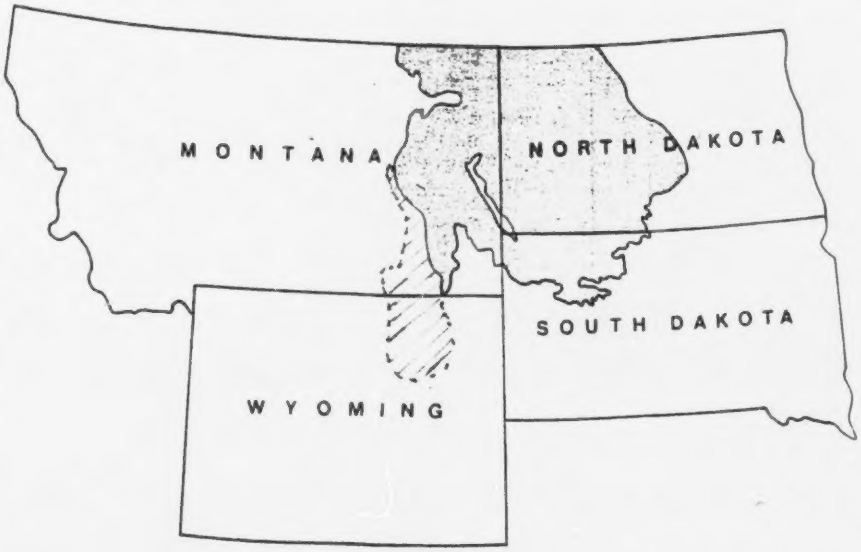
The low level of interest in Federally owned lignite reserves may have been due to the availability of rich beds of low sulfur subbituminous coals found in the nearby Powder River Basin (Figure B-1). Due to their higher energy content, the cost of transporting subbituminous coals, on a per Btu basis, is much lower than the cost of shipping lignite. This factor gives subbituminous coal an insurmountable economic edge over lignite in the competition for distant energy markets to the east and south. Thus, the development of Fort Union lignites has been dependent on the establishment of markets in North Dakota, South Dakota and Minnesota. Since the region has always been a rural and rather sparsely populated area, industrial and domestic demand for power generated by lignite boiler fuels has historically been low.

Although local demand for electricity only increased moderately during the 1970's, the demand for power rose dramatically in the midwestern metropolitan centers to the east of North Dakota. While this development could not improve the marketability of Fort Union lignite outside of the

---

*By the end of 1980, almost all of the leasing and mining activity in the Fort Union coal region had taken place in North Dakota, consequently most of the discussion in this report focuses on this state. (Twenty out of 23 of the Fort Union leases are located in North Dakota which also accounts for 98% of the region's lignite production.)

FIGURE B-1 PROXIMITY OF FORT UNION LIGNITES
TO POWDER RIVER BASIN LOW SULFUR SUB-BITUMINOUS COALS


MONTANA
NORTH DAKOTA
SOUTH DAKOTA
WYOMING

☐ Fort Union Region (Lignite)

▨ Powder River Basin (Sub-bituminous coal) region, it did provide a market for electricity generated at mine-mouth power plants and transmitted to users in midwestern states. An abundant supply of water, plentiful reserves of lignite, a Class II EPA air quality designation and relatively short power transmission distances (compared to other western coal fields) made North Dakota attractive to industry as a site for mine-mouth power plants designed to serve the midwest.[6]

During the 1970's five large new lignite-fired power generating units were brought on line; four additional units were under construction in 1980.* North Dakota may also be the site of the Nation's first commercial-scale coal gasification plant. All of these facilities are to be fueled by North Dakota lignite. In the past ten years, production levels have tripled in response to this added demand. By 1990, current levels of production will need to double again in order to meet the requirements of new mine-mouth coal conversion facilities currently in the final planning stages or under construction. Lignite consumed by these new coal conversion facilities will be supplied by seven major strip mines producing anywhere from one to twelve million tons per year. As of 1980, all of these mines were either operating or under construction.[7,8]

Like other western states, resource ownership in much of North Dakota is characterized by tracts of Federal lignites found in a checkerboard pattern interspersed with state and fee coal lands. However, the Federal government controls only 25% (5.6 million acres) of the coal bearing land in North Dakota. No other western state has such a small proportion of Federal reserves. The large tracts of nonfederal coals made the acquisition of federal leases of less importance to mine development than in other western states. All of North Dakota's seven largest mines are located in areas where their owners have obtained the rights to mine large reserves of privately held fee coal interspersed with smaller tracts of federal and state coal. Federal reserves held in leases amount to 212 million tons out of over 1.4 billion tons controlled at these mines or less than 15% of the reserves. More often than not coal was leased by operators of North Dakota mines to fill out a logical mining unit dominated by nonfederal coal. Unlike other coal regions, there has been little, if any, speculative leasing of Federal coal in North Dakota.[9]

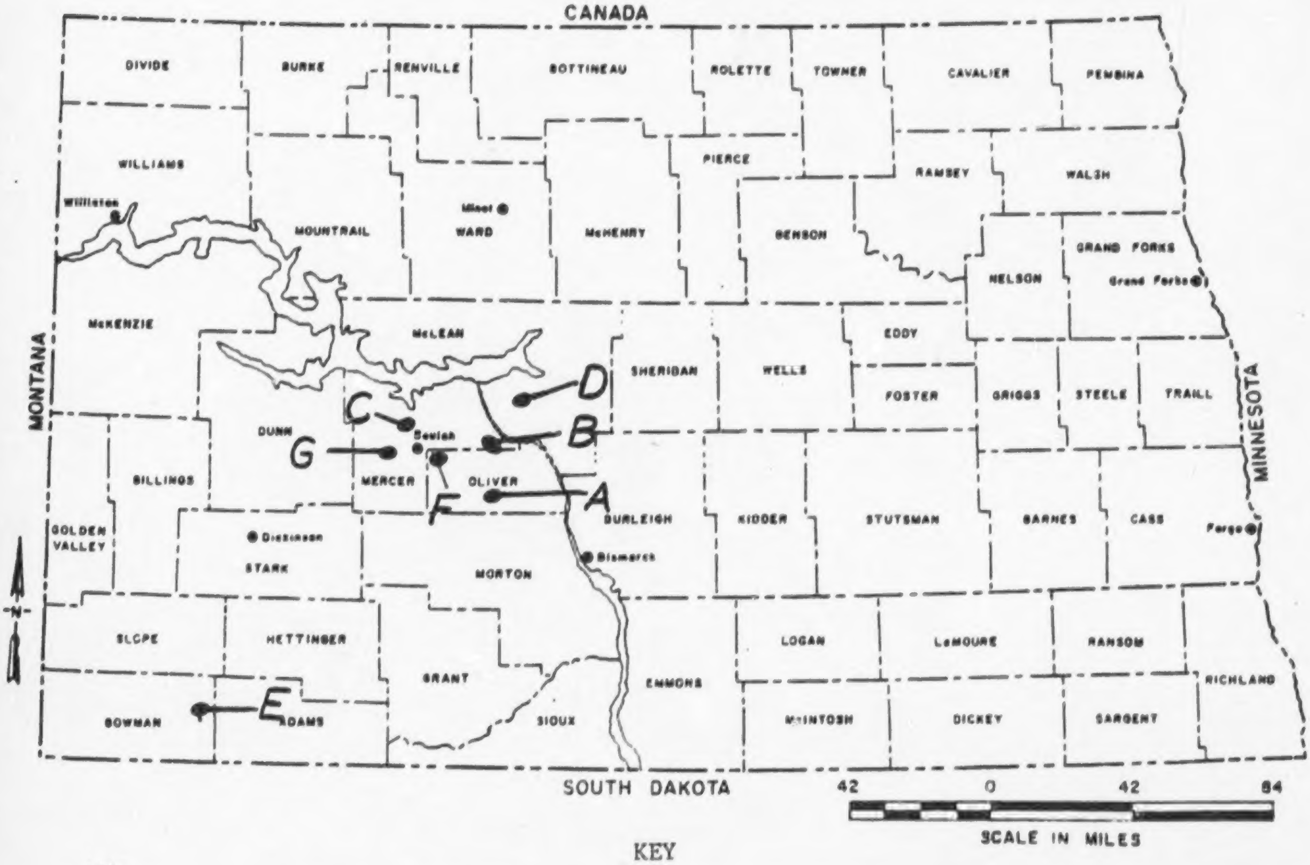
---

*The five new units, located at four sites (including one in South Dakota) have a combined generating capacity of 2124.5 megawatts. The four units under construction in 1980 have 1827 megawatts of designed capacity.

In order to consolidate lignite holdings into large contiguous units, operators of all seven major mines were required to obtain federal coal leases. Figure B-2 provides a map of the location of North Dakota's seven largest mining operations as well as a key depicting the 1979 production levels of each mine, its expected production capacity and associated federal leases. As can be seen from the table, these seven operations include 12 of the 20 North Dakota Federal coal leases within their respective project boundaries. Six of the seven mines are located in three bordering counties, Mercer, Oliver and McLean. Since most of the state's mining and power generating capacity is located in these three counties, much of the report's discussion will be in reference to them.

In order to assess the development prospects of existing federal coal leases in the Fort Union region, it is imperative to identify those factors which will encourage or constrain future lignite mining in the area as a whole and North Dakota, in particular. Aspects of development that must be examined include market factors, federal and state regulations, and institutional and logistical constraints. As explained above, since Fort Union lignite sales are limited to markets in or near North Dakota, and since almost all lignite mining in the region occurs in this state, the

Figure B-2
Location of Major Mining Operations in North Dakota


CANADA
DIVIDE
BURKE
RENVILLE
BOTTINEAU
ROLETTE
TOWNER
CAVALIER
PEMBINA
WILLIAMS
Williston
MOUNTRAIL
Minot
WARD
McHENRY
PIERCE
BENSON
RAMSEY
WALSH
NELSON
GRAND FORKS
Grand Forks
McKENZIE
McLEAN
SHERIDAN
WELLS
EDDY
FOSTER
GRIGGS
STEELE
TRAILL
MONTANA
MINNESOTA
D
C
B
G
DUNN
Beulah
MERCER
F
OLIVER
A
BILLINGS
BURLEIGH
KIDDER
STUTSMAN
BARNES
CASS
Fargo
GOLDEN VALLEY
Dickinson
STARK
Bismarck
MORTON
N
SLOPE
HETTINGER
LOGAN
LaMOURE
RANSOM
GRANT
EMMONS
RICHLAND
BOWMAN
E
ADAMS
SIOUX
McINTOSH
DICKEY
SARGENT
SOUTH DAKOTA
42
0
42
84
SCALE IN MILES

KEY

Map Id #	Owner/Mine Name	1979 Production (mty)	Projected Peak Production (mty)
A	Baukol Noonan Inc./Center Mine	3.8	4.3
B	Consolidation Coal Co./Glenharold Mine	2.8	3.8-4.0
C	Coteau PropertiesCo./Buelah-Hazen Mine	0.0	12.0
D	Falkirk Mining Co./Falkirk Mine	1.8	5.6
E	Knife River Coal Mining Co./Gascoyne Mine	2.8	2.8
F	Knife River Coal Mining Co./South Beulah	1.8	4.0
G	North American Coal Co./Indian Head Mine	1.1	1.1

Source: 1980 Keystone Manual and OTA review of mine permit applications on file with the Office of Surface Mining, Denver, Colorado analysis will be limited to those issues that directly impact the development of leases located in North Dakota. Thus, in this report, national issues concerning coal development in general will be discussed only insofar as they affect development of North Dakota lignite.

REFERENCES

1. Cannon, James S., Mine Control: Western Coal Leasing and Development, Council on Economic Priorities, New York. 1978.

2. The North Dakota Lignite Council. "Facts About North Dakota Lignite," 1978.

3. Cannon, op. cit.

4. 1980 Keystone Coal Industry Manual, McGraw-Hill, 1980.

5. U.S. Department of the Interior, Automated Coal Leasing Data System. Printout dated September, 1980.

6. Bureau of Land Management, Draft West-Central North Dakota Regional Environmental Impact Statement on Energy Development. U.S. DOI, March, 1978.

7. Ibid.

8. OTA review of mine permit applications on file at the U.S. DOI Office of Surface Mining, Denver, Colorado.

9. Cannon, op. cit.

CHAPTER I - OVERVIEW OF NORTH DAKOTA LIGNITE RESOURCES AND MINING TECHNIQUES

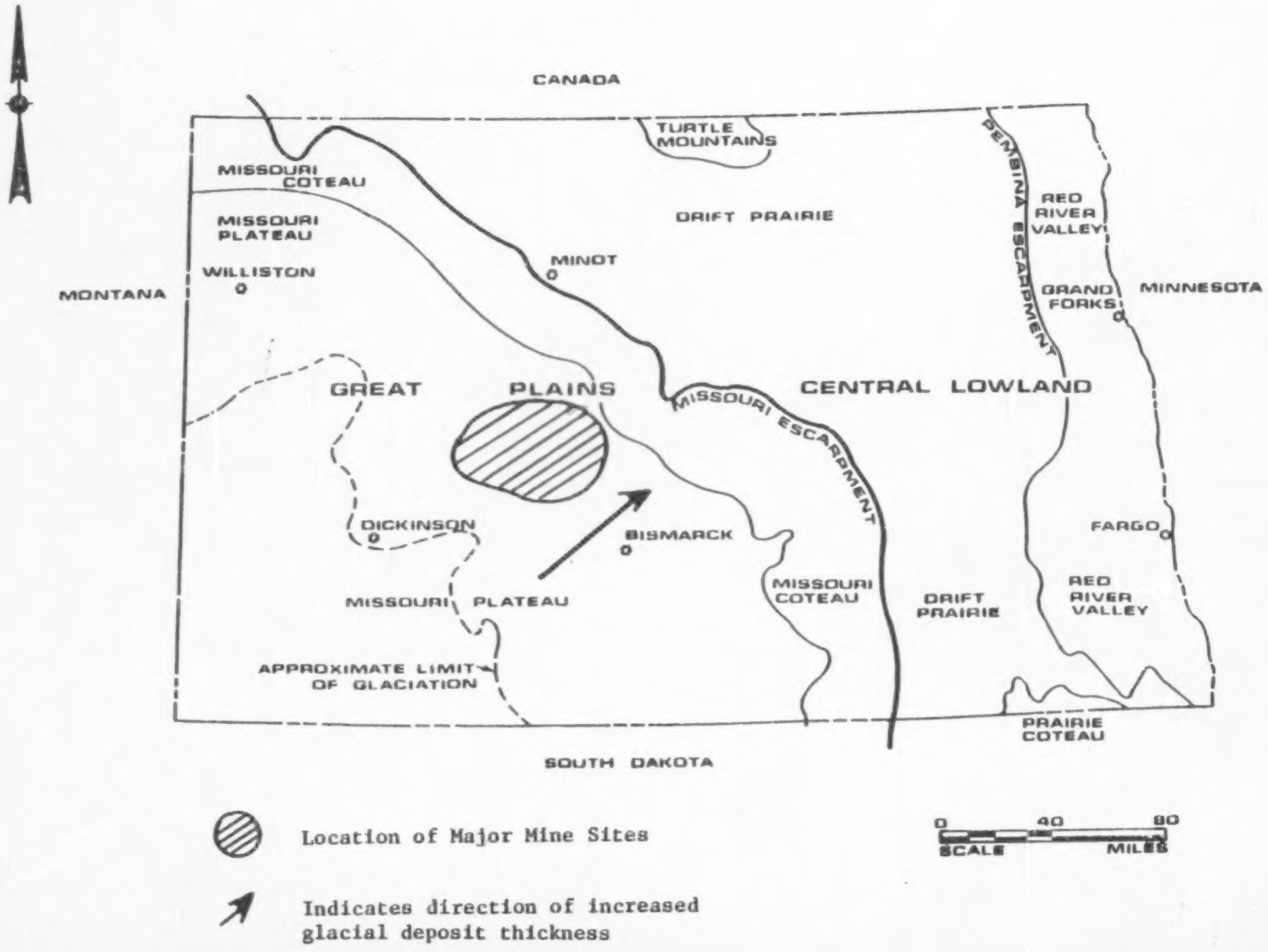
A. GENERAL DESCRIPTION OF THE ENVIRONMENT

- North Dakota is characterized by a flat to gentle rolling topography, 15 to 17 inches of annual rainfall and relatively rich soils.
- These dominant environmental factors provide conditions for mine operation and reclamation which may be better than any other region in the West.

The Fort Union Coal Region covers most of the western half of North Dakota. The sedimentary rocks of this region overlie the Williston Basin, a sedimentary and structural depression that covers much of the state and extends into Montana, South Dakota, and Canada. Coal beds of economic interest within the state are located in the Tongue River and Sentinel Butte Formations of the Fort Union Group. Other formations in the area contain coal that is too thin, impure and discontinuous to be of much economic interest. Since the state lies in one of the most seismically stable regions of the country, faulting is unusual in North Dakota and lignite seams seldom dip more than a few degrees in any one direction.[1,2]

The terrain is typified by a flat to very gently rolling topography. Most of the mining activity is located within the glaciated and unglaciated Missouri Plateau Sections of the Great Plains Physiographic Province in and around Mercer, Oliver and McLean Counties (Figure I-1). Generally, the thicker glacial deposits cover the areas north and east of the Missouri River. Those mines found in the northeastern section of the mining area are located along the Coteau Slope, which is mainly a dissected bedrock surface with less than 25 feet of relief. This area is overlain with a thick covering of glacial deposits. The glacial rock acts as a buffer between

FIGURE I-1 PHYSIOGRAPHIC SETTING OF MAJOR MINE SITES


CANADA
TURTLE MOUNTAINS
MISSOURI COTEAU
MISSOURI PLATEAU
DRIFT PRAIRIE
PEMBINA ESCARPMENT
RED RIVER VALLEY
MINOT
WILLISTON
MONTANA
GRAND FORKS
MINNESOTA
GREAT PLAINS
CENTRAL LOWLAND
MISSOURI ESCARPMENT
DICKINSON
BISMARCK
FARGO
MISSOURI PLATEAU
MISSOURI COTEAU
DRIFT PRAIRIE
RED RIVER VALLEY
APPROXIMATE LIMIT OF GLACIATION
PRAIRIE COTEAU
SOUTH DAKOTA
Location of Major Mine Sites
Indicates direction of increased glacial deposit thickness
0 40 80
SCALE MILES

fragile range and farmland soils on the surface and sodic layers of rock below. But, due to the occurence of this glacial material drainage in the area is poorly integrated and innumerable ponds, small lakes and sloughs are present in undrained depressions. With the exception of potential difficulties in reestablishing these wetlands, reclamation in this portion of the three county mining area should be much easier than in those areas a few miles to the southwest.[3,4]

In the southwestern reaches of the mining area, the landscape is covered with thinner layers of glacial deposits. The topography is still characterized by rolling prairie, but the relative lack of glacial deposits in this area has limited the extent and depth of neutral materials at the surface. Without this natural buffer, sodium and toxic metals found in the overburden may leach to the surface, making successful reclamation more difficult to achieve than in areas with glacial deposits. Both the glaciated and unglaciated regions are characterized by a light to moderate rainfall of between 15 and 17 inches per year, rich soils (compared to other western mine areas), and large supplies of underground and surface water.[5,6]

The major mining area lies near the Missouri River and Lake Sakakawea. This large, man-made lake contains a great reservoir of water that has made the area a prime site for coal conversion plants. Most of the land on which energy development has occurred or is likely to take place, has been cultivated or used as rangeland. Since such areas are not usually prime targets for concerned environmentalists, litigation by environmental groups seeking protection of pristine areas from mining and power plant construction activities has been rare in North Dakota. But, unlike any other coal producing state in the West, agriculture is by far the most predominate form of industry in North Dakota. The coal mining industry runs a distant second and thus any energy development perceived as environmentally destructive could run into opposition with the state's strong agriculture lobby. As of 1980, power plants and coal mines opened in west central North Dakota have managed to avoid major conflicts with agricultural interests and lignite production has increased steadily since 1970. Additional developments in Mercer, Oliver and McLean counties also appear to face little opposition from agriculture. This does not appear to be the case in other areas planned for energy development such as the Dunn-Center area where local opposition to planned synfuels facilities has been increasing over the last ten years. Despite the potential for conflicts, the dominant climatological, topographical, and geological characteristics of the state provide conditions for mine operation and reclamation which may be as good, if not better, than any other region in the West.[7,8]

B. CHARACTERISTICS OF THE RESOURCE BASE

- Approximately 350 billion tons, about two-thirds of the nation's lignite reserves, are found in North Dakota.
- Low Btu values, high moisture content and large concentrations of impurities are the major factors that restrict markets for lignite to areas within close proximity to the mine site.
- Despite its low heat content, lignite has proved to be an excellent fuel when used in properly designed coal-fired units.

About two-thirds of the nation's inplace lignite reserves--a total of 350 billion tons--are located in North Dakota. Underlying the western half of North Dakota, the lignite field extends into Canada, Montana, Wyoming and South Dakota. Strippable reserves of lignite have been estimated at 16 billion tons. Recoverable reserves are distributed over the entire field, but most of the mining activity to date has taken place in the North Dakota counties of Mercer, Oliver and McLean. The lignite beds are practially level and in most cases are covered with an impervious clay that prevents weathering of the resource even in areas where the cover is thin.[9,10] Unlike coal beds of the nearby Powder River Basin, which are typified by seam thicknesses of 50 to 100 feet and low overburden to seam thickness ratios, North Dakota recoverable lignite seams range from around 10 to 30 feet in thickness and lie at depths of up to 120 feet. Thus, truck and shovel coal mining operations characteristic of the Powder River Basin are not found in North Dakota. Instead, the development of large area mines employing draglines is the common method of lignite recovery in North Dakota.

North Dakota lignite, which is characterized by a high moisture content (33.5 - 43.8%) and a low-BTU value (5,500 - 7,500 BTU/lb) is a relatively poor quality coal, especially when compared to other abundant commercially recoverable coals found throughout the U.S. Table I-1 displays the characteristic qualities of lignite mined in North Dakota. The cost of shipping lignite, on a per Btu basis, effectively prohibits its economical transport over long distances by rail. Handling characteristics of lignite further complicate its transport. After lignite has been extracted and exposed to air and moisture, it begins to slake (crumble into fine particles), becomes susceptible to oxidation and subsequently develops a tendency to ignite spontaneously. Oxidation is best controlled by storing the lignite in tightly compacted piles and limiting exposure time by burning the coal at mine-mouth facilities. The Knife River Coal Mining Company, supplying coal from its Gascoyne mine to the Big Stone Partner's Power Plant 350 miles away, has resolved its transport problems by shipping its coal in specially designed covered hopper cars that protect the coal from exposure to rain or snow.

TABLE I-1
AVERAGE AND RANGE OF COAL QUALITY FOR NORTH DAKOTA LIGNITE

	Average	Range
Moisture	37.9%	33.5 - 43.8%
Volatile Matter	26.7%	24.1 - 30.2%
Fixed Carbon	29.2%	25.2 - 32.9%
Ash	6.2%	4.4 - 8.0%
Btu per lb. (as rec'd)	6783	5960 - 7487
Sulphur	0.6%	0.2 - 1.4%

SOURCE: 1980 Keystone Coal Industry Manual

Relatively high concentrations of sodium and heavy metals found in lignite may also account for this coal's failure to appeal to export markets. The sodium salts tend to clog coal-fired plant exhaust systems, while the heavy metals, especially arsenic, may be a potential hazard to ground water quality if ash is improperly disposed. Sodium concentrations in the lignite are highly variable throughout any one mine site. By blending coal at the mine, overall sodium concentrations can be lowered to acceptable levels before delivery to the utility.[12,13]

The above characteristics of lignite--especially the low BTU values and high moisture content--are the major factors that restrict markets to areas within close proximity to the mine site. Potential export markets are further limited by the availability of higher quality subbituminous coals found in the nearby Powder River Basin of Montana and Wyoming. Subbituminous coals not only have a higher BTU content per pound, but also have lower concentrations of impurities. (This is particularly evident when a comparison of impure concentrations is made on a per BTU basis.) Table I-2 illustrates the superior quality of subbituminous coal over lignite.

TABLE I-2

COMPARISON OF SUBBITUMINOUS AND LIGNITE COAL

Composition	Subbituminous Coal	Lignite
Moisture (as rec'd)	20%	35%
Fixed carbon (as rec'd)	38%	30%
British thermal units/lb (as rec'd)	9,000	6,800
Sodium dioxide	0.5%	2%
Calcium oxide (lime)	15%	25%
Magnesium oxide	4%	8%
Arsenic	2 ppm	5 ppm
Boron	50 ppm	150 ppm
Barium	200 ppm	700 ppm
Mercury	0.08 ppm	0.13 ppm
Lead	6 ppm	3 ppm
Uranium	0.7 ppm	1.1 ppm
Zinc	7 ppm	2 ppm

Source: Bureau of Land Management. Draft West-Central North Dakota Regional Environmental Impact Statement on Energy Development, U.S. DOI, March, 1978.

Despite its low heating value, lignite has proved to be an excellent fuel when utilized for steam generation. North Dakota coal has been successfully burned in properly designed stokers, pulverized coal-fired units as well as cyclone furnaces. Although North Dakota lignites are not of uniform quality, differences in coal chemistry have not been a major factor affecting the development of one lignite bed over another. Rather, the major factors affecting development have been the geophysical characteristics governing mineability of a particular lignite reserve and the presence of identified markets.[14]

Some lignite deposits in North Dakota contain substantial quantities of leonardite. Leonardite is a soft, earthy, medium brown, coal-like substance that results from the oxidation of lignite outcrops. Although it is a poor fuel (approximately 4,000 Btus per lb.), it is useful in a variety of industrial and agricultural processes. For many years it has been used as a dispersant and viscosity control agent in oil-well drilling muds, as a stabilizer for ion-exchange resins in water treatment, as a soil conditioner, and as a source of water soluble brown stain for wood finishing.[15]

Most mine operators tend to ignore their leonardite reserves, returning them to the earth with other components of the overburden. However, several companies in North Dakota are actively extracting or processing leonardite. For example, in the southwestern corner of the state, Knife River Coal Mining Company extracts leonardite from its Gascoyne mine and sells 60,000 tons per year to a nearby leonardite processing plant, owned by American Colloid. Knife River projected that its Gascoyne mine could supply American Colloid's processing plant with leonardite for the next 50 years. American

Colloid also holds a lease consisting largely of leonardite deposits near Williston in western North Dakota. Development of this lease will depend on the construction of a new processing plant in the vicinity of this lease. Geo Resources Exploration, Inc. operates both a leonardite mine and a leonardite processing plant near its federal lease also in the Williston area.

C. TYPICAL MINING PROCEDURES AND EQUIPMENT

- North Dakota lignite mining operations typically employ more than one dragline and are designed to produce 2 or more million tons of lignite annually.
- Lignite seams with greater than 120 feet of overburden are not generally mined although some lignite has been recovered at depths of 150 feet.

Seventy-three underground mines were operating in North Dakota at the turn of the century. With few exceptions, most of these mines were small, family owned operations that supplied coal for domestic and commercial use. Mining in soft sandstone and shale along with other hazards, such as fire, made most of these mines quite unsafe. These unsafe working conditions, coupled with the introduction of steam powered draglines, rendered the underground mining of lignite obsolete.[17]

Today, electric-powered draglines dominate the list of equipment employed by mining companies in North Dakota. New mining operations typically employ more than one dragline and are designed to produce 2 or more million tons of lignite annually. Although a few specialized or older mines will remain in operation, the definite trend is toward larger scale, highly productive operations geared to supply coal to mine-mouth electric power and synfuels facilities.

Mining conditions throughout North Dakota are quite similar and, therefore, most coal companies follow the same general mining procedures. Typically, the mining of lignite requires six major operations. First, the necessary water control structures, such as sedimentation ponds and diversions, are designed and constructed. After completion of this preliminary work, the topsoil in the area to be mined is stripped by scrapers and/or dozers. The topsoil is then segregated according to surface owner, shaped into piles as designated by the State Public Service Commission and the U.S. Office of Surface Mining, and seeded. After removal of the topsoil, the second lift material, the subsoil, is stripped and moved from the area. Seeding this material is required to protect it from wind and water erosion. Lastly, the remaining overburden is removed with electric powered draglines.[18]

During mining, overburden from each succeeding cut is placed in the trench immediately preceding it. Larger draglines, using a bench about 60 feet deep, are needed to recover reserves located down to 120 feet. Lignite with an overburden thickness greater than 120 feet is not generally mined, although up to 150 feet of overburden was removed at the Baukol-Noonan's Center Mine operation.* For removal of thicker overburden, earth moving scrapers are utilized to remove the excess overburden from hilltops in advance of the dragline stripping operations. Otherwise, thick overburdens must be rehandled by the dragline.[19]

Following the dragline operation, a bulldozer or front-end loader removes any loose materials from the top of the coal seam. With multi-seam beds, heavy equipment must be used to uncover lower seams, unless the interburden is more than eight feet thick in which case a dragline is used. Stripping operations usually continue 24 hours a day, seven days a week year around.[20]

*Although lignite with overburden thickness greater than 120 feet is not generally mined, it is interesting to note that North Dakota's USGS regional office is now counting reserves down to 150 feet.

Once the overburden is removed, the coal either is stripped by a large bulldozer or drilled and blasted with a mixture of ammonium nitrate and fuel oil. The amount of blasting needed at any one operation is dependent on the fibrous qualities of the lignite found at the site. Blasting is seldom used at some mines, while at others it is used extensively. Front end loaders or electric loading shovels dump the coal into 120 to 180 ton diesel or electric powered coal haulers. Coal loading usually only takes place during the two daytime shifts.[21]

After removal, the coal is transported from the pit up a graded ramp along unpaved haul roads to the coal preparation facility (tipple). Here the coal is dumped, crushed to size and, if required, blended to minimize the average sodium content. The coal is then either sent on a conveyor belt to a mine-mouth generating facility, stockpiled, or loaded into railroad cars for shipment.[22]

REFERENCES (Chapter 1)

1. Bureau of Land Management, Draft West-Central North Dakota Regional Environmental Impact Statement on Energy Development, U.S. DOI. March, 1978.

2. 1980 Keystone Coal Industry Manual, McGraw-Hill. 1980.

3. Bureau of Land Management, op. cit.

4. Groenewold, Gerald H., et al., Geology and Geohydrology of the Knife River Basin and Adjacent Areas of West-Central North Dakota. North Dakota Geological Survey. 1979.

5. Ibid.

6. Wiener, Daniel P. Reclaiming the West, Inform, Inc. 1980.

7. Englerth, Ed., North Dakota Public Service Commission Reclamation Division. Interview comments, September 1980.

8. Cannon, James S. Mine Control: Western Coal Leasing and Development, Council on Economic Priorities. New York, 1979.

9. 1980 Keystone Manual, op. cit.

10. Bureau of Land Management, op. cit.

11. Knife River Coal Mining Company, Mining and Reclamation Plan Submitted to United States Geological Survey for the Gasgoyne Mine. January, 1977.

12. Ferguson, John. North Dakota Geological Survey interview comments. September, 1980.

13. Mace. Alan, Knife River Coal Mining Company interview comments. September, 1980.

14. 1980 Keystone Manual, op. cit.

15. Bureau of Land Management. Technical Examination/Environmental Assessment--Glenharold Mine (Draft). U.S. DOI, May, 1979.

16. Mace. op. cit.

17. "Facts About North Dakota Lignite." The North Dakota Lignite Council, 1978.

18. OTA review of mine permit applications on file at U.S. DOI Office of Surface Mining, Denver, Colorado.

19. Ibid.

20. Ibid

21. Ibid.

22. Ibid.

CHAPTER II - POTENTIAL MARKETS AND CONSTRAINTS TO MARKET DEVELOPMENT

A. EXISTING AND PROJECTED MARKETS FOR NORTH DAKOTA LIGNITE

- During the 1970's, five new electric power units (2124.5 MW combined capacity) fueled by North Dakota lignite began operation. Due to these recent developments, lignite production tripled in the last 10 years reaching over 15 million tons in 1980.
- Four more power plants (1827 MW combined capacity) and the Nation's first commercial-scale coal gasification facility are currently under construction. Operation of these facilities could double the present demand for North Dakota lignite by the mid-1980s.

Poor quality and handling characteristics limit the market for North Dakota lignite to within several hundred miles of the western half of the state. Before the 1970's and promulgation of the Clean Air Act Regulations, there was only a small market for lignite. In 1960, only 2.5 million tons of North Dakota lignite were mined, a figure that, by 1969, had increased to only 5 million tons. Most of this coal was sold to small local power generating facilities or purchased as fuel to heat commercial buildings and single family dwellings.[1]

In the early 1970's, several midwestern metropolitan areas were classified as nonattainment regions because they failed to comply with the sulfur dioxide standards in the Clean Air Act. While the demand for electric power continued to grow in these regions, regulations promulgated by the U.S. Environmental Protection Agency prohibited the construction of new power generating units fueled by high sulfur coals (unless the facilities were equipped with costly SO_2 removal technologies). This period was also characterized by rising prices of imported oil, shortfalls in natural gas production and eventual passage of the Fuel Use Act, which prohibited the building of new oil and gas fired electric power plants. To meet the growing demand for electricity, these midwestern cities had to choose from one of three options: 1) purchase low-sulfur subbituminous coals mined in the west to fuel new and existing generating facilities, 2) import electric power from other states or 3) add sulfur removal equipment to their power plants.

While these developments did not improve the marketability of North Dakota lignite outside of the state, they did provide a market for electricity generated at mine-mouth power plants and transmitted to users in other states. An abundant supply of water, plentiful reserves of lignite, relatively short power transmission distances and a Class II EPA air quality designation made North Dakota attractive to industry as a site for mine-mouth electric power plants. During the 1970's, five new generating units fueled by North Dakota lignite began operation (including one power plant in South Dakota). Four more units are currently under construction and three additional applications for building permits have been submitted to the North Dakota State Department of Health. Because of these developments, lignite production tripled in the last 10 years—reaching over 15 million tons in 1980.[2,3]

Recent national policy initiatives to develop a synthetic fuels industry may provide additional new markets for North Dakota lignite. To further reduce the Nation's dependence on imported oil, the Federal government recently (August 1980) provided a consortium of energy companies with a $250 million loan guarantee to begin construction of a coal gasification facility in Mercer County, North Dakota.* Preconstruction activities began in August, 1980; the plant was scheduled to be in operation in late 1984. The first unit will convert 22,000 tons of lignite daily (4.7 million tons per year) into 125 million cubic feet per day (mcf) of high-Btu gas, the equivalent of

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*The Great Plains Gasification Associates were granted another, much larger loan guarantee totalling $1.5 billion dollars in December of 1980.

20,000 barrels of oil per day. Construction of an additional 125 mcf unit is also planned for this site. In January, 1979, Nokota Industries, Inc. announced plans to site another synfuels facility in the Dunn-Center area of North Dakota. In 1980, the U.S. Department of Energy provided Northern Natural Gas Company and 12 other industrial and utility firms, known as the North Dakota Synthetic Fuels Group, with a three million dollar grant to study the feasibility of constructing a third synthetic fuels plant located in Oliver County.[4]

Table II-4 provides a list of current consumers of North Dakota lignite. The list includes electric utilities, sugar manufacturers, leonardite processors, a charcoal briquette plant, as well as unspecified commercial and residential consumers. Over 90% of this lignite is used for electric power generation. Although specialized markets will remain important to small operators, future North Dakota lignite consumption will be contingent on the growth of the coal conversion industry.

The generating capacity of power plants fueled by North Dakota lignite already far exceeds the current demand for electricity within the state. In the future, excess power from existing facilities, and from those planned or under construction, will be exported to consumers in the midwest. As shown in Table II-1, much of the current power generating capacity in the state is associated with relatively new plants. In 1979, over 70% of the North Dakota lignite consumed in power generation was being utilized by plants built since 1970. Most of the lignite, around 9 million tons, was consumed by five mine-mouth power plants located on three sites. The trend towards the development of large mine-mouth facilities is exemplified by the four power generating units currently under construction in North Dakota (see

TABLE II-I SUMMARY OF CURRENT AND PROJECTED NORTH DAKOTA LIGNITE CONSUMPTION
(Estimated for Permitted Facilities Only)

End Use	Capacity	Total Consumption (M Tons) 1979	1985	Percent of Total Consumption By Mine-Mouth Facilities 1979	1985
Power Plants on Line Before 1970	719.2 MW	4.0	4.3	27%	33%
On Line Between 1970 & 1980	2124.5 MW	10.6	12.3	76%	80%
On Line After 1980	1840.0 MW	0	10.2	--	100%
Sub Total		14.6	26.8	63%	80%
Gasification Plants Operating After 1980	125 mcf/day	0	4.7	--	100%
Other	N/A	1.0	1.0	30%	30%
Total		15.6	32.5**	61%	81%

*Current and projected consumption figures include markets for lignite located outside North Dakota (e.g., The Big Stone Partners Power Plant in South Dakota).

**A cogeneration agreement between Great Plains Gasification Associates and Basin Electric Power Cooperative could reduce the amount of coal consumed by mine-mouth power plants by 2.6 million tons per year. If the agreement holds, total demand for lignite would be about 30 million tons in 1985. This estimate is contingent on the building of the Great Plains synthetic fuels plant which at this time, 1980, is quite uncertain.

Table II-5. These units, all scheduled to be in operation before 1984, will consume a total of 10.2 million tons of lignite per year. Phase I of the Great Plains Gasification project, also a mine-mouth facility, will consume an additional 4.7 million tons per year. By 1985, 12.3 to 14.9 million tons of additional lignite production will be required to fulfill the needs of new mine-mouth coal conversion facilities in North Dakota. If the Phase II gasification plant is constructed as planned, annual lignite production in the state will more than double--reaching over 34 million tons by 1990.[5,6,7]

As shown in Table II-6, construction permits for three additional power generating units and an additional synthetic fuels facility have been filed with the North Dakota State Department of Health. Another power generating plant is also on the drawing board along with Phase III and Phase IV of the Great Plains Gasification Project. The Department of Energy (1980) funded a feasibility study for an additional synfuels facility to be located near Center, North Dakota. At peak capacity, these facilities would require more than 35 million tons of lignite each year above the 34 million tons that will be consumed by existing and permitted facilities in 1990.[8]

These future developments depend on environmental restrictions, economic conditions, and the markets both for electricity and synthetic fuels. With the exception of the Great Plains Gasification plant, it is reasonable to expect that most, if not all, of the permitted facilities identified on Table II-5 will be in operation before 1990. Production expectations for the remaining facilities that have yet to be permitted (shown on Table II-6) are not nearly as high.

B. POTENTIAL CONSTRAINTS TO MARKET DEVELOPMENT

- Using EPA guideline models, the North Dakota State Department of Health determined that available sulfur dioxide increments will be exceeded in North Dakota Class I designated areas if any additional coal conversion plants beyond those already permitted are granted permission to build lignite-fueled facilities in west central North Dakota.
- At this time, it appears that the number of additional lignite-fueled, mine-mouth coal conversion plants built in North Dakota may be limited to those facilities that have already obtained air emission permits from the State Department of Health and those that can obtain offsets from existing facilities.

North Dakota lignite currently fuels 12 power plants with a combined capacity of over 2,600 megawatts (MW). Power plants located in North Dakota account for 2,000 MW of this electric generating capacity. At this time (1980), North Dakota power production more than meets the needs of the state's residents and industry. An additional 1840 megawatts of power generating capacity will be available when four additional units, also located in North Dakota, go into operation in the early 1980's. At that time, North Dakota will be exporting 85 to 90 percent of the electricity produced in the state. [9]

Recent economic conditions have depressed the demand for electric power transmitted from North Dakota. Basically, the decline in industrial activity in and around midwestern cities, combined with the relatively mild winters of the past two years, has resulted in a reduced growth in demand for electricity. This situation, though perhaps temporary, has delayed the scheduled openings of power plants. Basin Electric Power Cooperative, for example, has pushed back construction schedules for its Antelope Valley Station No. 1 and 2 units to the spring of 1983 and fall of 1985 respectively. [10,11]

While the slack in electricity demand may be temporary, the Prevention of Significant Deterioration (PSD) provisions contained in the Clean Air Act may limit markets for North Dakota lignite to those facilities currently permitted. One of the first states in the nation to adopt PSD Regulations, North Dakota has a well established air quality evaluation system. While there are no non-attainment areas located in North Dakota, the state has two Class I areas. Class I areas, as designated by the Clean Air Act amendments of 1977, include all national parks and wilderness areas which exceed 5,000 acres in size. In North Dakota, these areas include the Lostwood National Wilderness Area, in the northwest central portion of the state, and the Theodore Roosevelt National Park, located in western North Dakota. [12]

The air quality monitoring and modeling conducted by the North Dakota State Department of Health indicates that available air quality increments of sulfur dioxide at Theodore Roosevelt National Park will be exceeded if any additional power plants or synfuels facilities are permitted in west central North Dakota. In 1977 and 1978, using state-of-the-art models developed by the U.S. Environmental Protection Agency, the Department of Health found that the operation of five coal conversion units (associated with three facilties) under review at that time would result in sulfur dioxide concentrations which exceed allowable Class I PSD 24-hour sulfur dioxide increments at the National Park. Although northwesterly winds prevail in the area of the park (i.e., in the direction which would blow SO_2 air emissions generated in Mercer/Oliver Counties away from the park), intermittent air flow from the east would carry enough sulfur dioxide to increase periodic concentrations at the park beyond the daily increments allowable by law. [13]

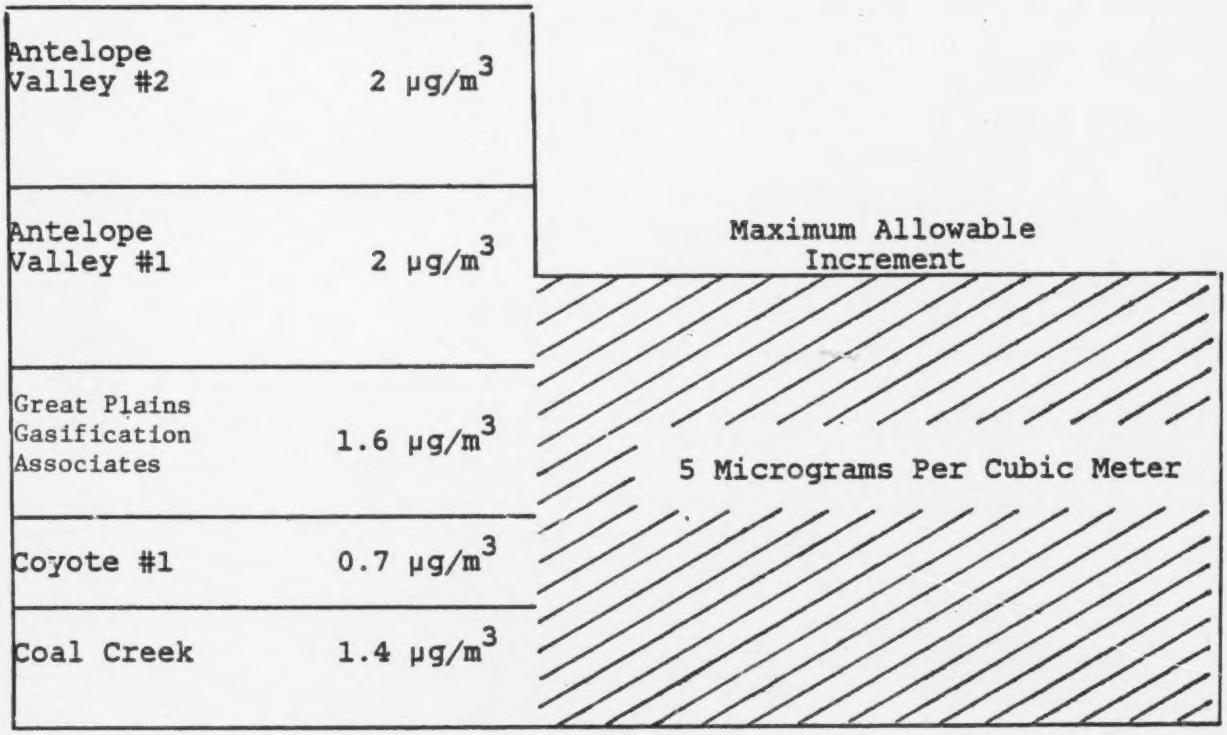
The permit applications included in the PSD review in 1977 and 1978 included: United Power Association's Coal Creek units 1 and 2 (a facility which had a permit to construct); Montana Dakota Utilities' Coyote #1 facility; Great Plains Gasification Associates' coal-to-gas plants, Phase I and II; and Basin Electric's Antelope Valley Station Units 1 and 2. As shown in Figure II-1, incremental concentrations resulting from the construction of these facilities would exceed maximum allowable concentrations of sulfur dioxide within the park boundaries. Since Basin Electric was the last of the four organizations to file a construction permit application, it was told to redesign its Antelope Valley units in order to reduce sulfur dioxide emissions below the 1977 New Source Performance Standards (1.2 pounds SO_2 per million BTU input). Basin Electric resubmitted its application and was subsequently granted permission to build. As can be seen from Figure II-2, the Basin Electric project left no room for additional concentrations of sulfur dioxide at the park. The following map, Figure II-3, shows how the recently permitted power generating facilities will affect the Class I park areas.[14,15]

Since that time, several Permit to Construct applications have been submitted to the Department of Health. Power plant operators, especially those planning or considering the construction of additional facilities, have argued that the EPA models used to measure remaining sulfur dioxide increments at Theodore Roosevelt National Park are not reliable beyond distances of 50 to 70 kilometers. Most of the development in Mercer and Oliver Counties is taking place more than 150 kilometers from the park.[16]

The State Department of Health recognizes the limitations of the EPA short range models, but lacks the resources to develop, test and verify a

FIGURE II-1

INFLUENCE OF SULFUR DIOXIDE EMISSION SOURCES
UPON PREVENTION OF SIGNIFICANT DETERIORATION
CLASS I ALLOWABLE INCREMENTS
IN THE THEODORE ROOSEVELT NATIONAL PARK
(24-HOUR SULFUR DIOXIDE LIMITATION)



SOURCE: Final West-Central North Dakota Regional Environmental Impact Statement on Energy Development: U.S. BLM, October 1978.

NOTE: ug/m^3 = micrograms per cubic meter

FIGURE II-2

INFLUENCE OF SULFUR DIOXIDE EMISSIONS FROM PERMITTED SOURCES UPON PREVENTION OF SIGNIFICANT DETERIORATION CLASS I ALLOWABLE INCREMENTS IN THE THEODORE ROOSEVELT NATIONAL PARK (24-HOUR SULFUR DIOXIDE LIMITATION)

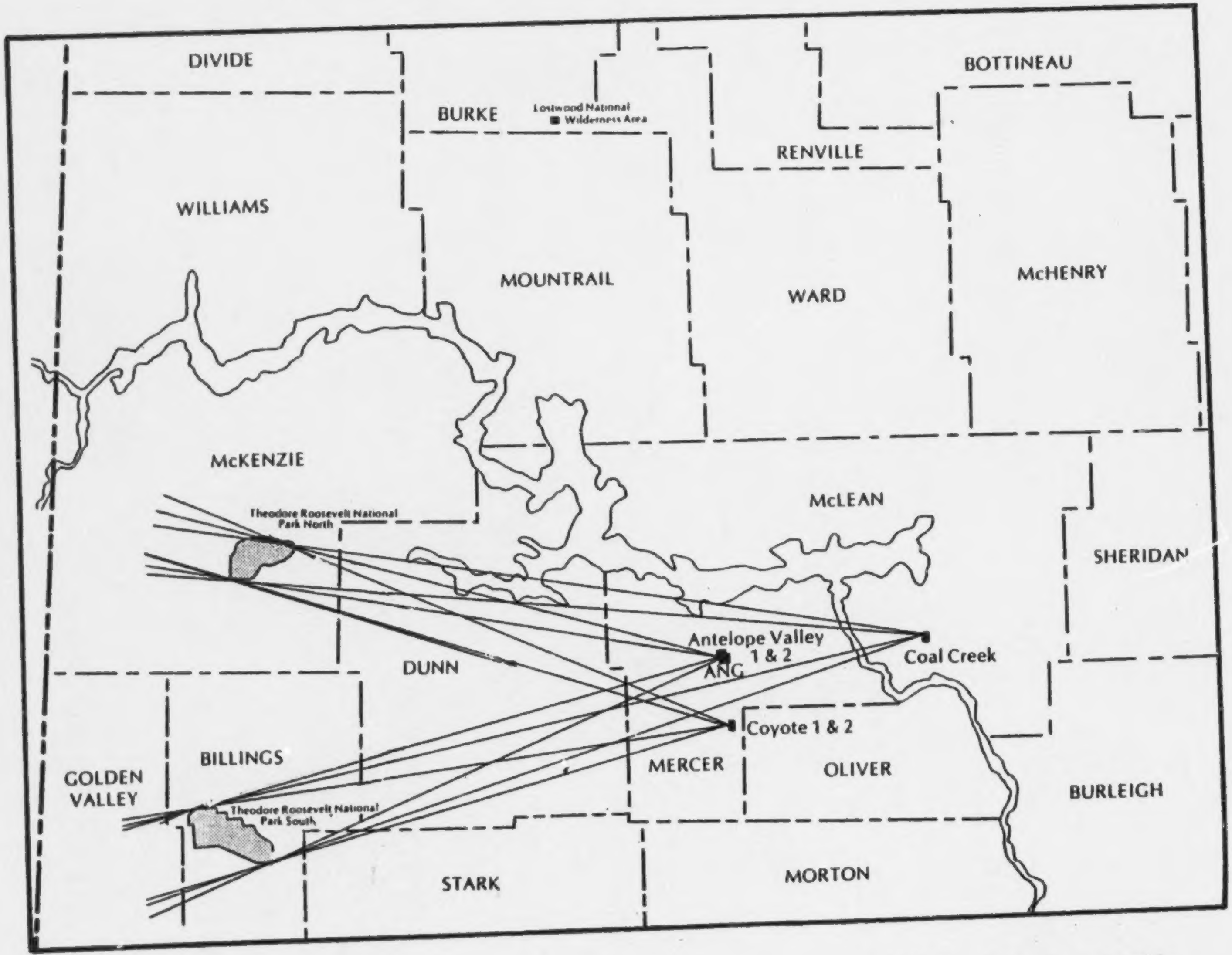
		Maximum Allowable Increment
Antelope Valley #1 & #2	1.3 $\mu g/m^3$	5 Micrograms Per Cubic Meter
Great Plains Gasification Associates	1.6 $\mu g/m^3$	
Coyote #1	0.7 $\mu g/m^3$	
Coal Creek	1.4 $\mu g/m^3$	

SOURCE: Final West-Central North Dakota Regional Environmental Impact Statement on Energy Development: U.S. BLM October 1978.

NOTE: ug/m^3 = micrograms per cubic meter.

FIGURE II-3

RELATIONSHIP OF RECENTLY PERMITTED (1979) SOURCES TO THE THEODORE ROOSEVELT NATIONAL PARK WITH WIND FLOW VECTORS


DIVIDE
BURKE
Lostwood National Wilderness Area
RENVILLE
BOTTINEAU
WILLIAMS
MOUNTRAIL
WARD
McHENRY
McKENZIE
McLEAN
SHERIDAN
Theodore Roosevelt National Park North
Antelope Valley 1 & 2
ANG
Coal Creek
DUNN
Coyote 1 & 2
GOLDEN VALLEY
BILLINGS
MERCER
OLIVER
BURLEIGH
Theodore Roosevelt National Park South
STARK
MORTON

SCALE: ½ inch = 1 mile

SOURCE: Final West-Central North Dakota Regional Environmental Impact Statement on Energy Development: U.S. BLM, October 1978.

long range air quality model. The state offered to work in conjunction with the federal government towards development of a long range transport (LRT) model but received no assistance from the Environmental Protection Agency. Recognizing that evidence generated by the new LRT may be more reliable, the Department of Health suggested that a construction permit would be approved only if the applicant could produce evidence indicating that sulfur dioxide increments are available in the Class I area. Several energy concerns, that have air emissions permits pending (Table II-2), did develop LRT models and submit them to the state permitting agency. The results of these independent analyses indicated new power plants could comply with the PSD Class I SO_2 increment. As of this time (Dec., 1980) the State Department of Health is still reviewing and evaluating the LRT models and modeling techniques utilized by the energy developers in their submissions. The method of review has been to obtain copies of the applicants models, install them on the state computer system, and using a meteorological data base developed in-house review the LRT model and modeling work presented by the applicants. The procedure is time consuming but unavoidable since the number of variables, assumptions and techniques used by each of the applicants analyses is great. The Department's general approach is to standardize the variables used by each of the applicants as much as possible during the review process.[17]

No conclusions have been reached by the Department of Health at this point in time (Dec., 1980). If, according to the Department's evaluation, any SO_2 increments remain at the park, permits would be granted, probably on a first-come, first-serve basis to as many applicants as the available increment will allow. On the other hand, should the Department's analysis demonstrate that the increment is full, no Permits to Construct will be granted.[18]

From the Department of Health's standpoint, the major problem in making a final decision lies in the fact that no EPA gudeline on long-range transport modeling is now in place nor was the issue addressed in the Clean Air Act Amendments of 1979. The Department plans to make a definitive decision concerning the applications currently under review by late spring (1981).[19]

Thus, it appears that construction of coal conversion facilities in Mercer and Oliver Counties (and the areas between them and the park) could potentially be limited to those plants which are already permitted. The lack of available air quality increments may prevent the construction of the three power generating units, one synfuels facility, and two sour gas (sulfur removal) treatment plants listed in the table below. Applications for air emission permits have not even been submitted for either the Coyote II generating facility (Montana-Dakota Utilities and partners) or the Phase III and IV synfuels facilities planned by the Great Plains Gasification Associates (Table II-6).

Understandably, potential owner/operator(s) of these energy plants are unwilling to commit additional funds for other necessary permits unless an air emissions permit is obtained. Thus, even if air quality increments are made available at a later date, this delay may have either constrained or prohibited the eventual construction of all these facilities.

TABLE II-2 - NORTH DAKOTA DEPARTMENT OF HEALTH PENDING AIR EMISSIONS PERMITS[20]

Company	Operation	Type	Capacity
Nokota	Unnamed	Coal to Methanol	96,000 BBl/day
Basin Electric	AVS III	Power Plant	500 MW
Basin Electric	Sunrise	Power Plant	1,000 MW
Warren Petrol.		Sour Gas Treatment	30 MCF/day
AMOCO		Sour Gas Treatment	100 MCF/day
Minnesota Power and Light		Power Plant	1,000 MW

Competition among different resource development industries for air quality increments, even if available, would probably affect development of lignite reserves. Because North Dakota's western oil and natural gas resource areas overlap the Fort Union lignite region, gas extraction and refining facilities that would have been located in the areas between Theodore Roosevelt National Park and existing areas of coal development would have competed directly for any available sulfur dioxide increments. In general, oil and natural gas production would not involve major air quality considerations; however, much of the gas in this area is sour (i.e., contains hydrogen sulfide). The sulfide concentrations in this gas can reach levels of up to 24%. As a result, sour gas presents potential air quality problems when flared or treated in sweetening plants. Any available Class I increments at Theodore Roosevelt Park could be lost to development and expansion of the gas sweetening plants listed on Table II-2. Gas refining units can be built rather quickly and these two plants will locate close to the park. If new gas wells continue to be found near the park, additional lignite fueled coal conversion plants would not likely be permitted.[21]

Therefore, it appears that the number of mine-mouth coal conversion facilities may have reached a plateau in North Dakota.

Any additional lignite development will apparently be dependent on the ability of lignite consumers to design and site facilities that do not affect or have minimal impact upon the air quality of Class I areas. If increments are not available, potential developers of new coal conversion facilities have two choices--either obtain offsets from existing facilities or obtain government issued variances. The second of these two options is unlikely to be successful as there is no national precedence for PSD variances being granted either by a federal land manager, a governor, or the President.[22]

As discussed above, a decline in the demand for electricity in general, and for electricity generated with North Dakota lignite in particular, has delayed the opening of several power plants in the state. At the same time, what appeared to be a steadily expanding market for high-Btu gas produced from North Dakota coal conversion facilities may not exist due to the emergence of abundant supplies of unregulated natural gas from new wells. Because the production of high-Btu gas via coal gasification may prove much more costly than conventional gas, additional delays in expansion of lignite production are possible.

Following the Federal Energy Regulatory Commission's (FERC) approval of a financial plan for the Great Plains Coal Gasification Project, suits were filed for General Motors Corporation (the Nation's largest single consumer of natural gas) and by agencies representing three states that would eventually consume this synthetic gas. The suits were designed to block a special surcharge that FERC had recently allowed the Great Plains consortium. The surcharge would have been passed on to customers of the consortium companies, who supply almost one-third of the nation's natural gas markets. In addition, the consortium would have been allowed to collect a special rate called an "all events tariff," to allow Great Plains to repay its debt within five years in the case of product failure. Overall, the coal-gas could cost $7.32 per million Btu's as contrasted with $3.12 for new natural gas or $5.70 for imported oil ($32/bbl). Two industrial trade associations--the American Iron and Steel Institute and the Process Gas Consumers Group--representing about 80% of the nations largest corporations filed a brief in support of GM and the three state agencies. These associations strongly oppose FERC's rate payer financial plan. The litigation has slowed preliminary construction activities on the project. After the lawsuits were filed, members of the consortium tried, unsuccessfully, to work out an alternative financing scheme because the water permit for the project was to expire if construction had not started in the fall of 1980. In addition, a cogeneration commitment with Basin Electric Cooperative's Antelope Valley Station was to expire in October 1980. Great Plains was able to maintain its commitments because construction was initiated in August 1980. [23]

But, in December 1980, a federal court decision disallowed FERC's approval of the Great Plains financial plan serving once again to put the project in limbo. Without an approved financial plan, the U.S. Department of Energy's loan guarantee of 1.5 billion dollars for the project could be retracted. The Great Plains Associates financial problems are further aggravated by recent discoveries of what could be large new supplies of natural gas. The new administration's proposed deregulation of natural gas prices will likely result in a surplus of natural gas supplies and thus eliminate the need for synthetic gas. These recent events have led the Great Plains consortium to propose the construction of a coal-to-methanol plant at the site which would cost less to build, use simpler technology and produce a fuel that would not have to compete with larger suppliers of less costly natural gas. Despite this move, the future of this facility is highly uncertain. It is unlikely that any synthetic fuels will be produced from the site before 1986.[24,25]

Price has not been the only obstacle to the establishment of a synfuels industry in North Dakota. Recently, public opposition has crystalized against the development of a second synfuels plant in North Dakota. This public opposition first appeared after the Great Plains Gasification Associates announced plans to build Phase I and Phase II of the gasification facility. According to American Natural Gas (ANG), then the sole sponsor of the project, 20,000 to 25,000 million cubic feet of water per day from Lake Sakakawea could supply as many as 25 gasification facilities. Soon after ANG announced these figures, Natural Gas Pipe Line (NGPL) company publicized plans to build another synfuels facility in the previously undeveloped Dunn-Center area of North Dakota.* Public reaction to this announcement was both quick and negative. In response to the public reaction, the North Dakota Water Commission decided not to grant a water permit and instead imposed an unofficial moratorium on the issuance of additional water use permits for energy facilities. At the same time, public interest groups attempted to have the Dunn-Center region designated as a Class I area. The inability to obtain a water permit, and the lack of remaining sulfur dioxide concentration increments at Theodore Roosevelt National Park eventually contributed to NGPL's decision in January, 1979, to drop its plans for a gasification facility.[26]

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*Although the Dunn-Center area contains large tracts of recoverable lignite reserves and is checkerboarded with extensive tracts of federal reserves, no federal leases have been issued in the area. There are no existing mines or power plants located in Dunn-Center.

Despite opposition to NGPL's proposal, Nokota Industries, Inc. decided to pick up where NGPL left off and, in February 1979, announced plans to build a coal to methanol/syngas facility at the Dunn-Center site. As a preliminary step toward obtaining the necessary permits, Nokota purchased NGPL's site specific research and proceeded to design a plant that would use only water found in the high moisture North Dakota lignite. However, Nokota must still contend with the lack of available air quality increments at Theodore Roosevelt National Park. The United States Department of Energy recently gave Nokota a grant for $4 million to assess the feasibility of constructing a coal to methanol plant at Dunn-Center, North Dakota. This DOE grant may have been made without an understanding of the concerns voiced by local interest groups or the potential for air quality constraints in this area of North Dakota.[27,28]

Recent events indicate that state officials are taking steps to establish even tighter controls over future energy development in North Dakota. The most recent example of this trend is the North Dakota Public Service Commission (PSC)'s rejection of the Northern Border Pipeline (NGPL) Co.'s proposed route for bringing natural gas from Alaska to the lower 48 states. PSC's stand on the proposed pipeline corridor was due to its siting over a number of environmentally sensitive areas.* The PSC action was not

*The pipeline was to be sited north and east of major North Dakota mining areas.

TABLE II-3
LEASE BLOCKS WITH ASSOCIATED MINING AND CONSUMING OPERATIONS

OWNER/MINE NAME	ASSOCIATED FEDERAL LEASES BLOCK NO.(S)	LEASE NO.(S)	DEV. STATUS[1]	CONSUMING FACILITY	OPERATOR	PROJECTED CONSUMPTION 1980	1985	1990	TYPE OF FACILITY	CAPACITY	NOTES
American Colloid/	1	M061025	U	None	N/A	N/A	N/A	N/A	N/A	N/A	No likely market identified
Baukol-Noonan/ Center	2	M043848	P	Milton R. Young	Minnkota Power Coop	4.2	4.2	4.2	Power Plant	234MW	Operating
				Square Butte	" " "				" "	438MW	Operating
				Unnamed	" " "	0	0	Unk.	" "	1000MW	Power plant air emissions permit pending.
				Unnamed	North Dakota Synthetic Fuels Group	0	0	Unk.	Coal gasification & methanol	65MCF & 21,000 bbl/day	
Consolidation Coal Co./Glenharold	3	M20209 M070203 M11269	P P A	Leland Olds #1 & #2	Basin Electric Power Coop	3.8	3.8	3.8	Power plant	656MW	Operating
Consolidation Coal Co./Renners Cove	4	M37829	U	None	N/A	N/A	N/A	N/A	N/A	N/A	No market identified
Consolidation Coal Co./Velva	5	M15896	A	Neil Station	Basin Electric Power Coop	0.25	0.25	0.25	Power Plant	42MW	Operating
				Commercial & Home Furnaces	N/A	0.045	0.045	0.045	Institutions, private homes	N/A	Operating
Coteau Properties Co./Beulah Hazen	6	M042819	U**	Antelope Valley #1	Basin Electric	0	2.6	2.6	Power Plant	440MW	Under construction
	7	M071813	P	Antelope Valley #2	" "	0	2.6	2.6	" "	440MW	" "
	8	M163	U	Great Plains Gasification Phase I	Great Plains Gasification Assoc.	0		(4.7)	Coal gasification	125MCF day	" "
				Phase II	" "	0	0	(4.7)	" "	" "	Permit to build approved.
				Phase III	" "	0	0	0	" "	Unknown	No permit application pending.
				Phase IV	" "	0	0	0	" "	Unknown	" " "
				Antelope Valley #3	Basin Electric	0	0	Unk.	Power Plant	500MW	Power plant air emissions permit pending.

[1] See key at end of table

TABLE II-3 (continued)

OWNER/MINE NAME	ASSOCIATED FEDERAL LEASES			CONSUMING FACILITY	OPERATOR	PROJECTED CONSUMPTION			TYPE OF FACILITY	CAPACITY	NOTES
	BLOCK NO.(S)	LEASE NO.(S)	DEV. STATUS[1]			1980	1985	1990			
Geo. Resources/ Nelson Pit	9	M065329	U	Geo Resources Exploration, Inc.	Geo Resources Exploration, Inc.	0.01	0.01	0.01	Leonardite Processing	N/A	Operating
Knife River Coal Mining Co./Gascoyne	10	BLM019127	A	Big Stone Power Plant	Big Stone Partners (MDU-OTP)	2.5	2.5	2.5	Power Plant	415	Operating
				Ortonville	Otter Tail	0.10	0.10	0.10	" "	15	Operating
				Unidentified	American Colloid	0.05	0.05	0.05	Leonardite Processing	N/A	Operating
Knife River Coal Mining Co./ New Leipzig	11	M437	U	None	N/A	N/A	N/A	N/A	N/A	N/A	Planned as source of lignite for Heskett #1 & 2; Hoot Lake (see S. Beulah Mine below)
	12	M438	U	None	N/A	N/A	N/A	N/A	N/A	N/A	
Knife River Coal Mining Co./ South Beulah	13	M047165	A	Heskett #1 & 2	Montana-Dakota Utilities	0.60	0.60	0.60	Power Plant	101	Operating
	14	M43083	U**								
				Beulah	" " "	0.08	0	0	" "	13	Phased out when Coyote becomes operational.
				Am Crystal Sugar		0.30	0.30	0.30	Sugar Beet Processing	N/A	Operating
				Hoot Lake	" " "	0.68	0.68	0.68	" "	148	Operating
				Coyote #1	Montana Dakota Utilities, Otter Tail Power, etc.	0	2.2	2.2	" "	410	Under construction
				Coyote #2	" "	0	0	Unk.	" "	410	No permit application for power plant.

[1] See key at end of table

TABLE II-3 (continued)

OWNER/MINE NAME	ASSOCIATED FEDERAL LEASES			CONSUMING FACILITY	OPERATOR	PROJECTED CONSUMPTION			TYPE OF FACILITY	CAPACITY	NOTES
	BLOCK NO.(S)	LEASE NO.(S)	DEV. STATUS[1]			1980	1985	1990			
Leroy Bonsness/ --	15	BLM018322	U	Commercial & Home Furnaces	N/A	0	0	0	Institutions, private homes	N/A	Mine closed
North American Coal Co./Indian Head	16	BK020273 M134980	A A	Stanton Plant	United Power Association	0.85	0.85	0.85	Power Plant		Operating
Falkirk Mining Co./ Falkirk	17	M31053	P	Coal Creek #1	" "	2.8	2.8	2.8	Power Plant	550	Operating
				Coal Creek #2	" "	0	2.8	2.8	" "	550	Under construction.
U.S. Steel/ --	18	M3831	U	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U.S. Steel/--	19	M3832	U	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Consumption						16.67	26.79	36.19[2]			

[1] Key: Developed leases:
A = Approved mine plan
P = Mine plan pending approval
U** = Associated with leases in approved or pending mine plans
Undeveloped leases:
U = Not included or associated with leases in approved or pending mine plans

[2] This total includes both Phase I and II of the Great Plains Gasification Facilities (9.4 mm tons). At this time, the construction of both Phases by 1990 is highly questionable. If Phase I is built it would consume 4.7 mm tons annually. If a cogeneration agreement is maintained between Great Plains and Basin Electric, total consumption of lignite would be reduced by 2.6 million tons per year.

a refusal to allow NGPL to build the pipeline, but, given the sensitive nature of the project, the state felt it should have a voice in the selection of the pipelines route. (The PSC proposed two alternative routes). PSC's decision has been challenged in two lawsuits filed independently by Northern Border and the Federal Energy Regulatory Commission. The State Attorney General is supporting PSC's decision to reject the pipeline route in a case where "State Rights" is rapidly becoming the salient issue. The outcome of the case may have an impact on other North Dakota energy projects funded by the Federal government, including the Nokota gasification facility.[29]

Waste disposal and socioeconomic issues will, to some extent, also constrain the utilization of lignite in North Dakota. Although these issues are important, they are not likely to impede lignite utilization as much as air quality constraints on the siting of mine-mouth coal conversion facilities.

The following table (Table II-3) provides a list of active and potential mines, existing/potential markets and associated federal leases. Of the 22 leases listed, nine are undeveloped. The remaining 13 have been incorporated into active mine plans or are associated with leases in active mine plans. Four of the undeveloped leases lack an identifiable potential market. For the American Colloid lease (Lease Block #1), Consolidation Coal Company's Renner's Cove site and the U.S. Steel leases, the likelihood of a market being identified before 1990 appears improbable.

Development of the American Colloid lease is unlikely, even though it could be used as a source of leonardite for American Colloid's processing plant located near Gascoyne, North Dakota. The American Colloid plant is

TABLE II-4
ESTIMATE OF NORTH DAKOTA LIGNITE CONSUMPTION BY CONSUMER

CONSUMER								PRODUCER		
OPERATOR	PLANT NAME	TYPE OF FACILITY	CAPACITY (MW)	LOCATION	DATE OPENED	CONSUMPTION 1979 (MTons)	CONSUMPTION 1980 (MTons)	OWNER/MINE NAME	TRANSPORT	TOTAL 1979 PRODUCTION (MTons)
Utilities										
Basin Electric	Leland Olds	Power plant	216.7	Stanton, ND	1966	3.112	3.0–4.2[2]	Consolidation/ Glenharold	Mine-mouth	2.815
Power Cooperative	#1 & #2		440		1975			NACCO/Indian Head	Rail	1.123
	William J. Neal #1 & #2	" "	15 15	Verendyne, ND	1952	0.26	0.25	Consolidation/ Velva	Rail	0.300
Big Stone Partners	Big Stone Power Plant	" "	415	Big Stone, SD	1976	2.50	2.50	KRCMC[4]/Gascoyne	Rail	2.785
Minnkota Power Cooperative	G.F. Wood #1, #2, #3	" "	5 5 11	Grand Forks, ND	1949 1950 1951					
" " "	Milton R. Young	" "	265.5	Center, ND	1970	4.20	4.20	Baukol/Noonan Center	Mine-mouth	4.250
" " "/ Minnesota Power & Light Co. (29.4%/70.6%)	Square Butte	" "	454	Center, ND	1977					
Montana-Dakota Utilities Co.	Heskett #1 & & 2	" "	25 75	Mandan, ND	1954 1963	0.60	0.60	KRCMC[4]/S. Beulah	Rail	1.790
	Beulah #1 #2	" "	7 7	Beulah, ND	1919 1919	0.08	0.08	KRCMC[4]/S. Beulah	Mine-mouth	1.790
Otter Tail Power Co.	Hoot Lake #1, #2, & #3	" "	7.5 54 75	Fergus Falls, MN	1948 1959 1964	0.68	0.68	KRCMC[4]/S. Beulah	Rail	1.790
	Ortonville Plant	" "	17	Ortonville, MN	1950	0.10	0.10	KRCMC[4]/Gascoyne	Rail	2.785

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[1] Otter Tail Power Co./Northwestern Public Service Co./Montana-Dakota Utilities.
[2] Recent production shortfalls at the Glenharold Mine have resulted in a drop in lignite consumption at the Leland Olds power plant.
[3] North American Coal Company.
[4] Knife River Coal Mining Company.

TABLE II-4 (continued)

	CONSUMER							PRODUCER		
OPERATOR	PLANT NAME	TYPE OF FACILITY	CAPACITY (MW)	LOCATION	DATE OPENED	CONSUMPTION 1979 (MTons)	CONSUMPTION 1980 (MTons)	OWNER/MINE NAME	TRANSPORT	TOTAL 1979 PRODUCTION (MTons)
Industry										
United Power Assoc./ Cooperative Power Assoc. (56%/44%)	Coal Creek #1	Power Plant	550	Falkirk, ND	1979	1.80	2.80	Falkirk(NACCO)/ Falkirk	Mine-mouth	1.795
	Stanton Plant	" "	172	Stanton, ND	1967	0.82	0.85	NACCO[3]/Indian Head	Rail	1.123
Am Crystal Sugar	Unidentified (2 plants)	Sugar Beet Processing Plant	N/A	Drayton, ND East Grand Forks, MN		0.49	0.50	Baukol/Noonan Noonan/Larsen	Rail	0.490
Am Crystal Sugar	Unidentified	" "	N/A	ND		0.15	0.15-0.30	KRCMC/S. Beulah	Rail	2.785
American Colloid	Unidentified	Leonardite	N/A	Gascoyne, ND		0.05	0.05	KRCMC/Gascoyne	Mine-mouth	2.785
Geo. Resources Inc.	Unidentified	" "	N/A	Williston, ND		0.01	0.01	Geo.Resources/ Nelson	Mine-mouth	0.01
N.L. Industries Barrold Division	Unidentified	" "	N/A	Gascoyne, ND		0.05	0.05	Arrowhead/Smith-Ullman	Rail	0.045
Husky Industries	Unidentified	Charcoal Briquettes	N/A	Dickinson, ND		0.22	0.22	Husky Industries Husky Mine	Mine-mouth	0.221
Commercial/ Domestic										
N/A		Commercial & home furnaces	N/A	Velva, ND		0.05	0.05	Consolidation/ Velva Mine	Truck	0.300
N/A		" "	N/A	New Leipzig, ND		0.005	0.005	Vernon Sprecher/ Sprecher	Truck	0.005
N/A		" "	N/A	Dickinson, ND		Unidentified	Unidentified	Dickensen/ Dickensen	Truck	
Total (including previous page)						15.599	17.9625			

Note: Unidentified entries refer to information that has not been obtained by OTA in time to be included in this report.

TABLE II-5
FUTURE NORTH DAKOTA LIGNITE CONSUMERS - APPROVED FACILITIES

	CONSUMER						PRODUCER		
OPERATOR	PLANT NAME	TYPE OF FACILITY	CAPACITY	PROJECTED CONSUMPTION (MTons)	LOCATION	STATUS/DATE ON-LINE	OWNER/MINE NAME	TRANSPORT	TOTAL PROJECTED PRODUCTION (MTons)
United Power Assoc./Cooperative Power Assoc.	Coal Creek Unit #2	Power plant	550 MW	2.8	Falkirk, ND	Under construction/ 11/80	Falkirk/Falkirk	Mine-mouth	5.6
Consortium[1]	Coyote #1	" "	414 MW	2.2	Beulah, ND	Under construction/ 5/81	KRCMC/South Beulah	" "	4.0
Basin Electric Power Cooperative	Antelope Valley #1	" "	438 MW	2.6[2]	Beulah, ND	Under construction/ 4/83	Coteau Properties Co./Beulah-Hazen	" "	9.4-14.6
Great Plains Gasification Assoc.	Great Plains Gasification Project - Phase I	Coal to high-BTU gas	125 mcf/ day	4.7[2]	Beulah, ND	Under construction/ 1985	" " "	" "	" "
	Phase II	" "	" "	4.7	Beulah, ND	Planned construction mid-1980s/1990	" "	" "	" "
Total				19.6					

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[1] Otter Tail Power Co./Minnkota Power Coop Inc./Montana-Dakota Utilities Co./Northwestern Public Service Co./Minnesota Power & Light Co. (35%/30%/20%/10%/5%).

[2] If Great Plains Gasification Associates and Basin Electric's cogeneration agreement holds, Great Plains will be providing Basin Electric with coal fines (a gasification byproduct) in quantities large enough to provide the Antelope Valley #1 and #2 units with one half of their fuel requirements thus reducing their combined lignite consumption to 2.6 million tons of lignite per year.

TABLE II-6

PLANNED NORTH DAKOTA LIGNITE CONSUMERS - FACILITIES WITHOUT PERMIT APPROVAL[1]

OPERATOR	PLANT NAME	TYPE OF FACILITY	CAPACITY	PROJECTED CONSUMPTION (MTons)	LOCATION	STATUS/DATE ON LINE	OPERATOR/MINE NAME	TRANSPORT	TOTAL PROJECTED PRODUCTION (MTons)
Otter Tail Power Co./Minnkota Power Coop, Inc./ Montana-Dakota Utilities Co./ Northwestern Public Services Co./Minnesota Power & Light Co.	Coyote #2	Steam Electric	410 MW	2.2	Beulah, ND	No permit application/Undetermined	KRCMC/S.Beulah	Mine-mouth	6.2
Great Plains Gasification	Phase III & IV	Coal to high-BTU gas	250mcf/ day	9.4	Beulah, ND	No permit application/post 1990	Coteau Properties Inc./Beulah-Hazen	Mine-mouth	18.8-24.0
Basin Electric Power Coop	Sunrise	Steam Electric Power Plant	440 MW	2.5	Unknown	Permit under review, application not complete, project on hold.	Unidentified	Unknown	Unknown
Minnesota Power & Light	Unknown	" " "	1000 MW	5.4	Center, ND	Permit application under review/ Undetermined	Baukol-Noonan, Inc./ Center	Mine-mouth	9.4
Basin Electric Power Coop	Antelope Valley #3	" " "	500MW	2.7	Beulah, ND	" " "	Coteau Properties/ Beulah-Hazen	Mine-mouth	21.5-26.7
Nakota Industries	Unnamed	Coal to Methanol	96,000 bbl/day	Unknown	Dunn, ND	" " "	AMAX/Unnamed	Mine-mouth	Unknown

[1] The lack of available air quality (SO_2) increments in a North Dakota Class I designated Air Quality Control Region (Theodore Roosevelt National Park) has prevented operators of these planned facilities from obtaining necessary air emisions permits from the North Dakota Department of Health. The Department of Health has indicated that it is not going to approve any of the air emissions permits currently under review. Thus, it does not appear that any of these facilities will be granted construction permits.

located within a mile of Knife River Coal Mining Company's Gascoyne Mine. According to one company spokesman, Knife River which currently supplies American Colloid with leonardite, has enough resources to supply the processing facility for the next 50 years. Furthermore, given the distance between the lease, located near Williston in the northwest corner of the state, and the processing plant, located in the southwestern part of the state, American Colloid probably will not be able to mine and transport the lignite at a lower cost per ton than they currently pay Knife River. [30,31]

Consolidation's Renner's Cove lease constitues only a small portion of the company's land and mineral holdings in this area of North Dakota. Although Consolidation's holdings in the lease area are quite extensive, the company has not secured a contract to supply the coal. Before 1978, Consol had plans to open a mine at the site and had even listed the site in the "New Coal Mine Development and Expansion Survey" section of the 1979 Keystone Coal Industry Manual. It is likely that the decline in the growth of electric power demand and the State Department of Health's uncertainty on granting new air emissions permits for coal conversion facilities resulted in Consol's abandoning the Renner's Cove project. The potential mine site was not listed in the 1980 issue of the Keystone Manual. [32,33]

While markets have been identified for the remainder of the undeveloped leases, this does not imply that the leases will be included in subsequent mine plans. Many other factors must also be considered--including planned mining sequence, environmental restrictions and the availability of transportion--before the viability of any one lease tract or block can be determined.

REFERENCES (Chapter II)

1. U.S. Department of the Interior, Bureau of Mines Minerals Yearbook. 1960 and 1969.
2. U.S. Department of the Interior, Bureau of Land Management Draft West-Central North Dakota Regional Impact Statement on Energy Development. January 1978.
3. National Coal Association. Steam Electric Plant Factors, 1979.
4. Energy ERA Newsletter "Consortium Assessing Options for Great Plains Gasification Plant" Bismark, N.D. January 31, 1981.
5. National Coal Association, op. cit.
6. U.S. Department of Energy, Energy Information Administration. State Energy Data Report. DOE/EIA-0214(78). April 1980.
7. North Dakota Public Service Commission. Unpublished data.
8. North Dakota Department of Health. Unpublished data.
9. National Coal Association, op. cit.
10. Energy ERA Newsletter, "ANG-Basin Electric Sign Power Supply Agreement," Bismark, N.D. October 31, 1980.
11. John Norton, Dakota Resources Council. Interview comments, September 1980.
12. U.S. Department of the Interior, Bureau of Land Management, op. cit.
13. Ibid.
14. Ibid.
15. Gene Christiansen, North Dakota Department of Health. Interview comments, September 1980.
16. North Dakota Department of Health, op. cit.
17. Gene Christiansen, op. cit.
18. Ibid.
19. Ibid.
20. Ibid.
21. U.S. Department of the Interior, Bureau of Land Management, op. cit.
22. Ibid.

23. Energy ERA Newsletter "Consortium Assessing Options for Great Plains Gasification Plant." Bismark, N.D.

24. Ibid.

25. Ibid.

26. Gene Christiansen, op. cit.

27. John Norton, op. cit.

28. Energy ERA Newsletter, DOE Makes Synfuels Grants," Bismark, N.D. December 31, 1980.

29. Energy ERA Newsletter, "N. Border and Feds Sue N.D. Officials," Bismark, N.D. September 30, 1980.

30. Boyd Klinger. Vice President, Mining and Exploration, American Colloid. Telephone interview comments. October 1980.

31. William Hansen, U.S. Geological Survey, Billings, Montana. Telephone communication. October 1980.

32. *1979 Keystone Coal Industry Manual*. McGraw-Hill. 1979.

33. *1980 Keystone Coal Industry Manual*. McGraw-Hill. 1980.

CHAPTER III - NORTH DAKOTA LIGNITE PRODUCTION - ENVIRONMENTAL ISSUES AND CONSTRAINTS

A. RECLAMATION--PROBLEMS AND CONSTRAINTS

- With few exceptions, reclamation regulations, as enforced by the U.S. Office of Surface Mining and the North Dakota Public Service Commission, have not posed significant constraints to the increased production of nonfederal and federal lignites in North Dakota.
- The cost and time consumed in developing mine permit applications for submission to the U.S. Office of Surface Mining, combined with the complex and lengthy review process conducted by OSM, may lead to some mine companies bypassing small quantities of federal lignites in lieu of their more plentiful reserves of nonfederal coal.

Enactment of federal environmental legislation during the 1960's and 1970's and the subsequent establishment of government agencies to implement these new laws prompted many complaints from coal interests who charged that coal development was being over-regulated. For North Dakota coal mine operators, the greatest impact has been the cost of complying with the Surface Mine Control and Reclamation Act (SMCRA) and OSM-associated regulations. However, these additional regulations have done little to alter the economic viability of mining in North Dakota except to encourage larger mining operations. Such economies of scale have enabled companies to pass along regulatory costs to lignite consuming utilities, without either cutting into their own profits or reducing the competitive position of electricity produced from lignite. Even with increased regulatory costs added to the price, lignite sells for less (per million BTU) than most other available fuels.

Reclamation is still a very young science; it will take decades before results of reclamation in North Dakota can be definitively evaluated. As practiced today, conventional overburden removal and placement into spoil piles inverts the stratigraphic layers of the earth's crust. Many researchers suggest that this approach to mining may, in the long run, prevent the recharge of important downstream aquifers. Although this concern may eventually be addressed with future research and possibly regulation, the enforcement of reclamation regulations has not posed any major constraints to the increased production and utilization of lignite in North Dakota. Mining will only be prohibited in those site specific cases where state and federal laws prohibit mining or increase costs to the point where reserves are no longer economically recoverable.[1]

Generally speaking, conditions for reclamation in North Dakota are excellent compared to other western states. More topsoil, greater precipitation, and a flatter terrain enhance the chances for successful reclamation. As described in Chapter I, the mining areas located in the western half of the state, are differentiated by the absence or presence of chemically neutral deposits of glacial till. Those mine sites with substantial deposits of glacial materials are located in the north and east portions of the mining region. With the exception of some difficulties in reestablishing wet lands, reclamation operations in these areas are not likely to encounter many problems. Mine sites in the southwestern section, however, do not have this glacial covering. Consequently, this area is more susceptible to problems with reclamation. The difficulty is caused by two distinct but related phenomena referred to as differential subsidence and "piping". Differential subsidence appears as sporadic depressions along the surface of reclaimed lands and is caused in part by the "shrink-swell" characteristics of clays in the reclaimed spoil piles. The shrink-swell factor is often intensified by the high pH of the spoils. The second phenomena, piping, occurs because of the combination of relatively thin layers of topsoil and the sodic nature of the spoils which increases the probability of cracks developing on the surface of reclaimed lands and enlarging into gullies. Overall, these phenomena have not had a major impact on the mining of federal coal, except to heighten reclamation costs.[2,3,4]

Although the issue of reclaimability of mined lands in North Dakota has been critically addressed, there are few indications that future federal and state regulatory practices will be changed. In the case of Inform's report,* for example, out of 15 mines addressed, three were located in North Dakota. One, Knife River Coal Mining Company's Gascoyne mine was rated by the report as having the worst reclamation record of all 15 mines. The rating was based on the small proportion of mined lands that had been reclaimed at the site. Contrary to Inform, the State Public Service Commission's Reclamation Division does not feel that the lack of progress at Gascoyne is a question of complete disregard on the part of Knife River. Although the Public Service Commission acknowledged that progress has been slow, reclamation is not likely to be a major problem at Gascoyne. The PSC attributed the lack of progress to rapid expansion of the mine during 1974-75 and the mining of coal from four pits using one dragline (a procedure followed at Gascoyne to facilitate coal blending activities).[5,6]

*Inform, Inc.'s 1980 publication, Reclaiming the West by Daniel P. Wiener

On the other hand, the Public Service Commission, in cooperation with the North Dakota State Game and Fish Department and the U.S. Office of Surface Mining, refused to approve a Consolidation Coal Company mining permit application. Denial of Consol's Glenharold application was based on provisions of the North Dakota Century Code which expressly prohibits destruction of the state's scarce wooded areas. Consol's application included a proposal which called for disturbance of a number of woody draws that cover the project area. The PSC has refused to let Consol disturb the woody draws until it shows that they can be reclaimed. In an article published in the Bismarck Tribune, Ed Englerth, Director of the PSC's Reclamation Division, explained that the PSC policy on woody draws stems from a few years ago when Consol mined near two large heavily wooded draws. According to Mr. Englerth the operation "made a general mess of things" and reclamation attempts were unsatisfactory. This case has not been resolved. In the meantime, Consol's production of lignite at the Glenharold site dropped almost a million tons from 1978 to 1979.[7]

With this exception, constraints due to the ability of coal operators to reclaim lands have been relatively unimportant. Given the lack of either alluvial valley floors or extensive woody areas on or around the remaining undeveloped leases in the state, reclaimability of mined lands probably will not be a major constraint to their eventual development. Despite this, reclamation has become an issue of contention between coal developers and the agencies with responsibility to ensure that mined lands will be reclaimed successfully. Many of the problems revolve around difficulties in developing and obtaining OSM approval of mining and reclamation plans. Mining and reclamation plans must be approved before an operator can obtain permission to mine coal leased from the federal government. The process of developing a mining and reclamation plan is both complex and costly. Many companies spend over a year and as much as a million dollars in developing a plan for submission to OSM. In many cases, OSM will find the plan incomplete or inadequate and require the company to rework a portion of the plan. Other times, OSM specialists may decide that lands planned for mining cannot be reclaimed with the procedures proposed by the coal operator. At this point, the approval process can become a lengthy and tangled mess. On the one side, OSM's major concern is to ensure that reclamation of federal lands will be successful and, on the other, mine operators must ensure that they can mine and reclaim the land in a cost effective manner. While both may wish to see the mined acreage successfully reclaimed, their respective approaches to reclaiming a specific site may be quite different. Due to the relatively unproven nature of various approaches to reclamation and the variety of site specific environmental conditions that can appear at each site examined by OSM, review of a mine permit application can take up to 18 months. A synopsis of the review process is provided below.

Once submitted by the mining company, the Office of Surface Mining examines the mine plan document for completeness. This Apparent Completeness Review (ACR) performed in house or by an OSM contractor may take from three to four months. Usually some aspect of the document is found to be insufficient and the coal company is requested to supply missing data or information. Fifteen to twenty days after the ACR process is completed, public notice of the proposed mining activity is posted in a local newspaper for two or three weeks. OSM then undertakes two studies of the proposed action. The first, termed a Technical Analysis, organizes the information in the mine plan according to regulation numbers in the Federal

Register and evaluates compliance of the proposed action with each of the coded laws. The second study, the Environmental Assessment, analyzes both site specific and regional environmental impacts associated with the proposed mining activity. Development of the two documents often takes as long as five to six months.[8]

If no problems surface, and approval of the application is recommended by the regional OSM office, the application is sent to the OSM Solicitors Office in Washington, D.C. for a final compliance review. This review, like the Technical Analysis performed earlier, is quite comprehensive in nature and usually requires two to three months to complete. If a mine plan passes this final review, it is sent to the Secretary of the Interior for signature. After receiving this last stamp of approval, coal companies can begin mining their federal leases.[9]

All companies planning to mine in North Dakota, whether on federal or non-federal land, must submit a mine permit application with the North Dakota Public Service Commission (PSC). Prior to SMCRA, the Public Service Commission was responsible for the monitoring of all mining and reclamation activities (North Dakota has had its own reclamation laws since 1969). Once SMCRA was enacted, states were required to promulgate regulations that were at least as stringent as the regulations promulgated by the U.S. Office of Surface Mining. Rather than deal with the complexity of creating a separate set of state regulations, the North Dakota legislature opted to copy OSM's regulatory language into its State law. The adoption of the federal regulations, however, has not resulted in the approval process consuming as much time as required by OSM. The State Public Service Commission is required to finalize its adequacy review and mine permit applications within four months. However, this time period may be extended. The shorter time required for the state PSC to process applications has resulted in industry directing the majority of its complaints at OSM and its permitting procedures.[10]

The effects that the OSM permitting process can have on the ability and/or willingness to pursue the development of coal leases is illustrated by the experience of the North American Coal Corporation (NACCO) and its subsidiaries (Falkirk Mining Company and Coteau Properties Company). During 1979 and 1980, North American and both its subsidiaries submitted mine plan applications to OSM. Both the Falkirk and Coteau mine plans contained small acreages of federal coal, in proportion to private fee coal acreage. (See Table III-1.) Like all existing federal coal leases in North Dakota none of the surface acreage included in the mine plans is held by the federal government.

TABLE III-1

NACCO MINE PLANS--FEDERAL AND FEE COAL ACREAGE[11,12,13]

Company	Mine Name	Federal Acreage	Private Acreage
North American	Indianhead	441	0
Falkirk Mining Co.	Falkirk Mine	160	2090
Coteau Properties Co.	Beulah-Hazen Mine	160	1240

At the Indian Head mine, NACCO had difficulty obtaining approval to mine a new federal lease directly south of its existing strip mine operation (See Figure III-1). NACCO planned to mine from south to north along the lease area. The southern portion of the lease is an area of low overburden

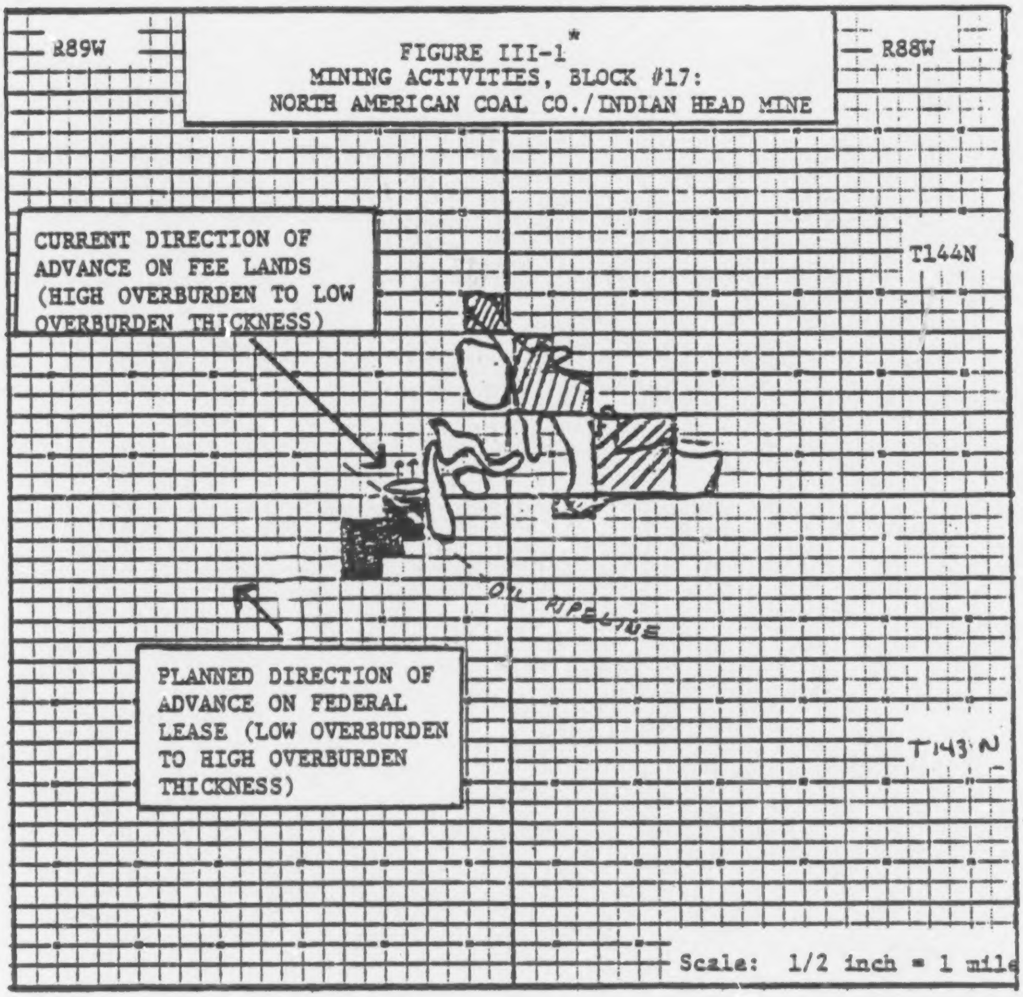
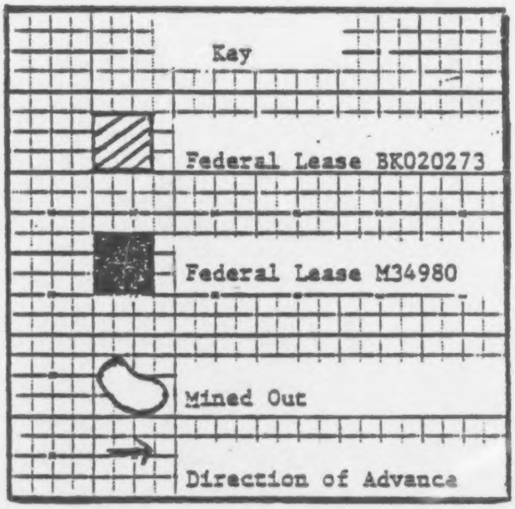


FIGURE III-1*
MINING ACTIVITIES, BLOCK #17:
NORTH AMERICAN COAL CO./INDIAN HEAD MINE

R89W
R88W
T144N
T143 N
CURRENT DIRECTION OF ADVANCE ON FEE LANDS (HIGH OVERBURDEN TO LOW OVERBURDEN THICKNESS)
PLANNED DIRECTION OF ADVANCE ON FEDERAL LEASE (LOW OVERBURDEN TO HIGH OVERBURDEN THICKNESS)
OIL PIPELINE
Scale: 1/2 inch = 1 mil

*Source: William B. Hansen
USGS, Billings,
Montana



Key

Federal Lease BK020273
Federal Lease M34980
Mined Out
Direction of Advance

to seam thickness ratio, while the northern lease section has overburden thicknesses of up to 140 feet. Originally the company planned to mine the lease while mining lignite from another pit opened directly north where the overburden is thickest, along the southern portion of the operation. This procedure would have enabled NACCO to mine areas of low overburden along the federal leases, while extracting fee coal with a high proportion of overburden. Conversely, the company could later mine federal coal with high overburden ratios while producing fee coal with low overburden ratios. The effect of simultaneously mining high and low overburden areas would have kept the selling price of lignite within NACCO's contract ceiling. By the time NACCO's mine plan was approved (September, 1980) mining had long since begun on their fee coal tract and the company's planned cost average sequence was thrown out of kilter. Since NACCO could no longer afford both to recover federal coal with high overburden, and to mitigate a nearby archeological site, the company submitted (December 24, 1980) an amended mine plan reducing federal coal production by 510 thousand tons. If this amended mine plan is not approved within what the company feels is a reasonable time frame, North American intends to bypass the federal lease altogether.[14,15]

North American's subsidiary, the Falkirk Mining Company, is also awaiting approval of a mine plan. The mine plan includes one 160 acre tract of federal coal, a lease obtained under the Emergency Coal Leasing Program. In this case, the town of Underwood requested that Falkirk move its operation from south of the community to tracts directly west of its border. Underwood requested this action so that Falkirk's mining operations would not interfere with the town's development plans. Falkirk agreed but cannot economically justify mining this new area without including federal reserves in the logical mining unit. As of November, 1980, OSM had not informed Falkirk when the mine plan might be approved and thus the company is beginning to question the prudence of this public relations move, made as a gesture of good will. If mining is not approved soon, Falkirk is likely to experience production shortfalls. In this case, both OSM and the North Dakota Public Service Commission are concerned over Falkirk's ability to contain slumping of reclaimed spoil piles at the site. The town of Underwood currently has plans to expand onto the mined area once it has been reclaimed. If slumping occurred, damage to future buildings could be extensive. (A more detailed discussion of Falkirk's mine plan is presented in Section C of this chapter.)[16,17]

North American's most recent mine plan application, made by its other subsidiary, Coteau Properties Company, also includes one 160 acre tract of federal coal. Aware of the difficulties in obtaining mine plan approval, Coteau has developed a set of contingency mine plans in the event of long delays at OSM. These alternative mine plans include no federal coal. Given the magnitude of Coteau's lignite holdings, over three billion tons, Coteau can afford to bypass the reserves included in the three federal leases it currently controls.[18]

As discussed earlier, the enforcement of reclamation regulations (including the OSM permitting process) has not significantly altered the contined expansion of North Dakota's lignite mining industry. But, the cost and potential delays associated with obtaining a permit to mine Federal coals could lead some operators to abandon their plans to mine through Federal lease tracts. Given the general pattern of resource ownership in the major mining areas (large acreages of nonfederal "fee" coal interspersed with small patches of Federal reserves) most of the current leaseholders can design their mines to bypass Federal coals. Historically, Federal lignite production has never accounted for more than 10 percent of the state's total output. Due to the vast quantity of nonfederal reserves held by the major mine companies, it isn't likely that production from existing Federal leases will ever account for more than 15 percent of the total. It is possible that OSM's permitting process has emerged as an issue in North Dakota because Federal coal is not absolutely essential for mining to proceed. In other western states, if the leaseholder doesn't accept environmental requirements imposed by OSM, he cannot mine the site.

In North Dakota, some companies appear to have avoided mining their Federal reserves until no other alternative was available. This may have been an attempt to avoid both the OSM permitting process and what may be perceived as more stringent environmental protection requirements. The concern over more rigorous environmental controls being imposed by OSM than by the State Public Service Commission is not apparent in the cases of Consolidation Coal Companies Glenharold mining permit application or the applications submitted by Falkirk. In any case, simplification and clarification of mine permit applications along with a program to lessen the time required to evaluate a mining and reclamation plan at OSM could reduce some of the complaints concerning the permitting process. However, in order for this to occur, staffing at OSM field offices will have to be increased.

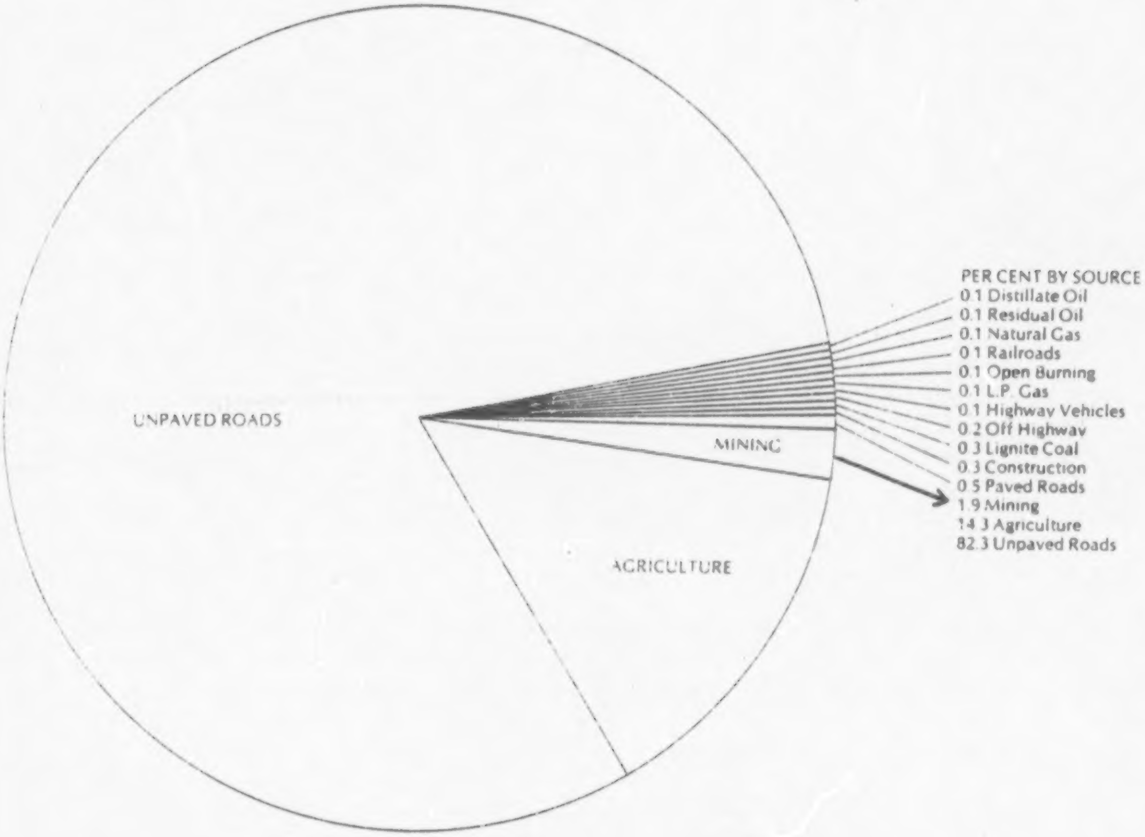
B. FUGITIVE DUST, WATER QUALITY AND WATER AVAILABILITY

- Compared to other sources of fugitive dust and surface water contamination (agriculture and unpaved roads), lignite mining is a minor contributor of emissions in North Dakota.
- North Dakota mining can be complicated by great influxes of water into the mine pit. In cases where seepage is occurring through the highwall there have been problems of instability and spoil pile slumping resulting in inefficient and potentially dangerous mining conditions.
- The potential disruption of aquifers during the mining of lignite seams, which are often the water bearing strata in North Dakota, is a potential constraint to some lignite operations.

Both area and point sources of particulate emissions are common in North Dakota. In 1975, mining contributed only two percent of the total suspended particulate emissions for a seven county area including the mining areas of Mercer and Oliver Counties. Agriculture and unpaved roads combined to produce 96.6 percent of the total emissions (See Figure III-2). Typically, mining operations will attempt to keep dust levels down in order to prevent fouling of equipment and to comply with existing federal and state regulations. The limited amount of blasting that occurs in lignite mining also serves to reduce the relative amounts of dust liberated during lignite extraction. It is unlikely that mining will influence particulate concentrations at the Class I designated Theodore Roosevelt National Park since the heavy particulates would tend to settle to the surrounding country side long before reaching the park. Even with increased mining activity, fugitive dust associated with mining will not contribute to as much as five percent of the total suspended particulates in the region. Nor does it appear likely that the liberation of dust from increased mining activity in the Mercer/Oliver County area will exceed ambient total suspended particulate standards. Thus, it is unlikely that liberation of dust

FIGURE III

1975 AREA SOURCE TOTAL SUSPENDED PARTICULATE EMISSIONS FOR THE SEVEN COUNTIES INCLUDING THE MINING AREAS OF MERCER AND OLIVER COUNTIES



Source: Draft West-Central North Dakota Regional Environmental Impact Statement on Energy Development: U.S. BLM, Jan. 1978.

emissions will limit the mining of lignite in North Dakota.[19]

Water enters mine project areas through precipitation, surface runoff, or percolation from surrounding aquifers. Before implementation of SMCRA, mine water contributed to degradation of local water quality when it left or was pumped from the mine site. Degradation was associated with outfluxes of sediments which increased the concentrations of dissolved solids (principally sodic salts) and heavy metals. State and Federal regulations currently stipulate that water entering and leaving the mine sites be captured in sedimentation ponds and allowed to settle or be treated with floculents before it is allowed to leave the project area.* Provisions in SMCRA specify design and size of sedimentation ponds as well as concentration of effluents in water emanating from mining operations. Although mine operators complain that the size and number of ponds is excessive and that water leaving the sites must contain effluent concentrations which are much lower than ambient concentrations found in surrounding environment (35 ppm vs. 135 ppm), the cost of water treatment has not shown itself to be a severe barrier to lignite mining. As with the fugitive dust issue, much greater concentrations of effluent originate from haul roads and agricultural operations than from mining operations. Thus increases or decreases in mining will have little influence on surface water quality in the future in North Dakota.[20,21]

The interception of underground aquifers during mining operations appears to be a growing problem in North Dakota. In many cases, the water bearing strata are above the coal bed planned to be mined or the aquifer is actually the coal seam itself. Thus, mining can be complicated by influxes of water into the mine pits. Knife River pumps over 50,000 gallons of water a day out of its Gascoyne operation, enough water to fulfill the requirements of a large electric power plant. While having to deal with these large quantities of water from a treatment standpoint can be problematic, drainage of aquifers into mining operations can have more serious side effects. For example, in cases where seepage is occurring through the highwall there have been problems of instability and spoil pile slumping resulting in inefficient and potentially dangerous mining conditions. Spoil pile slumping has been a problem at both of Knife River's North Dakota operations. Slumping of spoil piles at its South Beulah mine caused cessation of mining activities on one tract of federal coal three years ago. Knife River hopes that the purchase of a new 75 cubic yard dragline will alleviate the problem and allow the resumption of mining from the affected area.[22]

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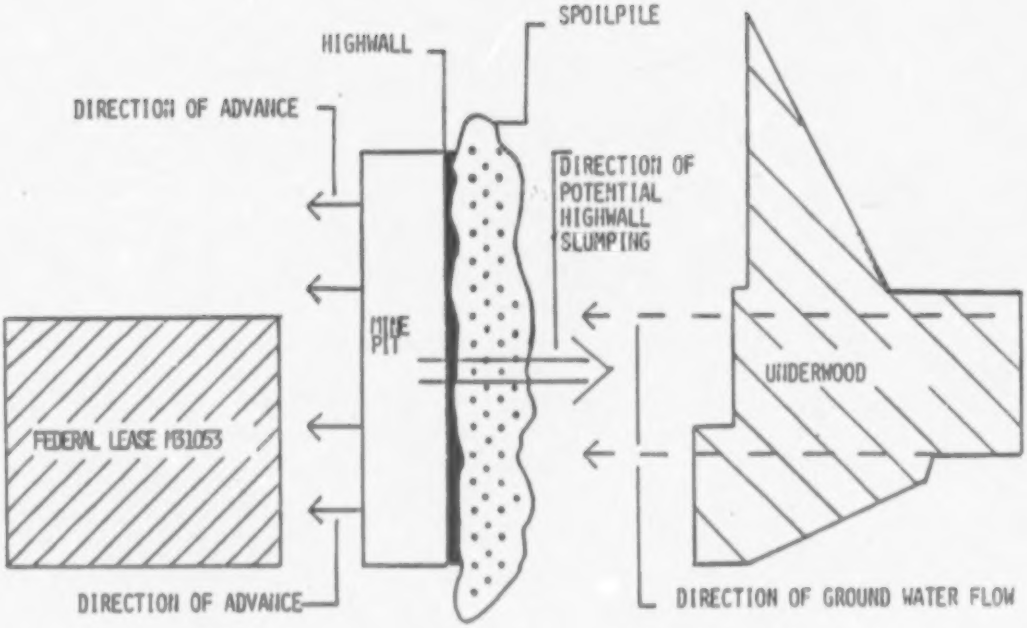
*Only a few mines use flocculation; most can meet effluent standards by simply providing sufficient settling time in appropriately designed ponds.

The potential for spoil pile instability and slumping is one of the major factors contributing to delay of Falkirk's mining permit application. As shown in the diagram below (Figure III-3), the flow of groundwater is in the same direction as the mining, thus seepage into the mine site will be through the spoils. The State Public Service Commission is concerned that an inability to control spoil slumping at the site may eventually result in the slumping of reclaimed areas behind the spoil pile. This is of particular concern since the town of Underwood is planning to eventually expand out onto the reclaimed areas.[23]

The Commission wants to know what mitigating measures Falkirk plans to employ if the spoil pile becomes unstable before they grant approval of the

FIGURE III-3

DIAGRAM OF POTENTIAL HIGHWALL INSTABILITY
AND SLUMPING AT THE FALKIRK MINE


SPOILPILE
HIGHWALL
DIRECTION OF ADVANCE
DIRECTION OF POTENTIAL HIGHWALL SLUMPING
MINE PIT
UNDERWOOD
FEDERAL LEASE M31053
DIRECTION OF ADVANCE
DIRECTION OF GROUND WATER FLOW

permit application. In addition, the Commission is withholding approval due to their concern over the operation's potential disruption of a major aquifer. In this case, the coal seam to be mined is in the midst of an enormous groundwater recharge area. While Falkirk has made commitments to provide alternative sources of water if Underwood's ground water supplies are disrupted, the company has not identified the extent of impacts beyond the immediate area. The potential effects are of particular concern in this area of North Dakota since 60 to 70 percent of the domestic and stock wells obtain water from shallow lignites.* Alternative groundwater sources are not readily available, since they generally occur at depths of over 1,000 feet below the surface. At this time it is unknown what type of stipulations the PSC and/or OSM will impose on Falkirk when the application is finally approved.[24,25]

Disruption of aquifers is only one of the effects that an expanded lignite mining industry may have on North Dakota's valuable groundwater resources. A recent study, conducted by a team led by Gerald H. Groenewold of the North Dakota Geological Survey, has identified a potential conflict between maintenance of regional groundwater quality and development of mine-mouth generating facilities. The study was designed to evaluate potential impacts of surface mine pit disposal of fly ash and flue-gas-desulfurization (FGD) waste. Fly ash and FGD wastes constitute the two major solid by-products of coal fired power plants. A common practice at mine-mouth generating facilities is disposal of these wastes in surface mine pits. Recently published results of the Groenewold study indicate that power plant fly ash wastes disposed of in this manner are hydrologically active and potentially hazardous to anyone consuming well water near the disposal site. Groenewold's research group concluded that FGD waste effluents were similar to those of the spoil piles within which they were disposed. Furthermore, FGD wastes were found to produce leach fluids with concentrations of toxic and non-toxic metals well within safe drinking water standards. In contrast, fly ash leachates were shown to be potentially toxic. Leachates from these wastes were found to have high pH values (between 11 and 13) and to contain concentrations of arsenic and selenium which exceed Primary Drinking Water Standards by a factor of 12 and 80 respectively. The research, which included laboratory and field geochemical analyses indicated that selective placement of the wastes in the spoil pile V's and careful site selection could alleviate much of the problem. Conclusions drawn from reports such as these could ultimately affect the provisions of safe drinking water laws in North Dakota.[26]

Another related concern is EPA's eventual classification of synfuels waste products. Originally, the Great Plains Gasification Associates planned to eliminate waste by concentrating toxics and injecting them to depths of 5,000 feet in wells where the waters are suggested to be two times as salty as sea water. This plan was eventaully dropped. Great Plains currently plans to use flash evaporators to produce a clay product from the aqueous waste streams. The dried waste will be disposed of in an approved surface or near-surface site.[27]

C. WILDLIFE AND CRITICAL NATURAL, PREHISTORIC AND HISTORIC AREAS

- With the exception of scarce woodland resources, the maintenance of natural or cultural resources has been a relatively minor problem to the expansion of lignite mining in North Dakota.

Intensive agriculture, transportation, mining and other developments have already changed the face of the North Dakota country side, eliminating natural habitats and historic features in areas where federal coal has been leased. Thus, constraints to lignite development associated with maintenance of existing vegetation, wildlife and areas of natural or cultural significance have only been of issue in a few specific cases.

North Dakota has no known endangered or threatened plant species. There are, however, six endangered species of wildlife, the black-footed ferret, the northern kit fox, the whooping crane, the eskimo curlew, the American peregrine falcon and the Arctic peregrine falcon that either inhabit or migrate through areas surrounding lignite regions. To date, mining activities have not been affected by the presence of any of these species. Wildlife habitats within the mining region consist of prairies, woodlands, wetlands, small areas of badlands, and mined lands. No mining has or is likely to occur in badland areas due to the topographical relief and because most of the coal has eroded away over time. Mining through wetlands, while causing some difficulties in reclamation, has not prevented the production of significant quantities of federal or fee coal. The removal of specialized prairie habitats, such as prairie dog towns, is not known to have been attributed to past mining in North Dakota and is not likely to result from the development of any federal coals in the future.[28]

The destruction of woody draws, a scarce woodland resource found in the lignite leasing region of North Dakota, has become a significant issue at Consolidation's Glenharold mine site. The woody draws, dominated by green ash, box elder and American elm are found throughout the Glenharold site in draws, valleys and along the north and east facing slopes of the project area. The understory, consisting of a mixture of shrub species, are places of refuge for deer and other wildlife. Consolidation's plan to place spoil within the draws has resulted in opposition from the State Public Service Commission, OSM and BLM, and delayed approval of Consol's mining permit application. With the exception of the Glenharold mine, other operations either contain no woodland areas or have managed to avoid disturbing these areas.[29,28]

The existence of prehistoric and historic sites in mining areas has not played a significant role in the development of federal coal except in a few site specific cases. Costs associated with mitigating a Native American archeological site (one of many that dot the North Dakota landscape) was one of several reasons cited by North American Coal for bypassing some federal coals in an area with an overburden greater than 120 feet in depth. But, this case was an exception and the question of mitigating archeological sites is not likely to be an issue of major significance to the mining of federal coal.[30]

REFERENCES

1. Clare Silvernale, U.S. DOI, Office of Surface Mining, Denver, Colorado. Interview comments, September 1980.
2. Wiener, Daniel P., Reclaiming the West. Inform, Inc. 1980.
3. U.S. Department of the Interior, Bureau of Land Management. Draft West-Central North Dakota Regional Impact Statement on Energy Development. January 1978.
4. Groenewold, Gerald H., et al., Depositional Settling and Groundwater Quality in Coal-Bearing Sediments and Spoils in Western North Dakota. 1981.
5. Wiener, Daniel P., op. cit.
6. Ed Englerth, North Dakota Public Service Commission. Interview comments, September 1980.
7. "Basin Electric Makes Plans for Coal Shortfall at Plant - Glenharold Problems Cited," by Malcolm Ritter. Bismark Tribune (no date; article on file at U.S. OSM, Denver, Colorado.
8. Clare Silvernale, op. cit.
9. Ibid.
10. Ed Engelrth, op. cit.
11. U.S. Department of the Interior, Office of Surface Mining. Environmental Assessment Proposed Expansion to the Indian Head Mine, North American Coal Company Federal Coal Lease #M-34980. July 11, 1980.
12. Falkirk Mining Company, Surface Coal Mining Permit Application. May 12, 1980.
13. Coteau Properties Company, Surface Coal Mining Permit Application. 1980.
14. William B. Hansen. U.S. Geological Survey, Billings, Montana. Interview comments, September 1980.
15. James Brown, North American Coal Company. Interview comments. September, 1980.
16. Ibid.
17. Ed Englerth, op. cit.
18. Jim Brown, op. cit.
19. U.S. Department of the Interior, Bureau of Land Management, op. cit.
20. Ibid.

21. Jim Brown, op. cit.

22. Alan Mace, Knife River Coal Mining Company. Interview comments. September 1980.

23. Ed Englerth, op. cit.

24. Ibid.

25. Groenwold, Gerald H., et al., op. cit.

26. Groenwold, Gerald H., et al. "Potential Effects on Ground Water of Fly Ash and FGD Waste Disposal in Lignite Surface Mine Pits in North Dakota." Proceedings FGD Symposium, Houston, Texas. October 28-31, 1980.

27. Norm Peterson, North Dakota Department of Health. Interview comments, September, 1980.

28. U.S. Department of the Interior, Bureau of Land Management. Draft West-Central North Dakota Regional Impact Statement on Energy Development. January, 1978.

29. "Basin Electric Makes Plans for Coal Shortfall at Plant-Glenharold Problems Cited," op. cit.

30. James Brown, op. cit.

CHAPTER IV: INFRASTRUCTURAL REQUIREMENTS AND CONSTRAINTS

A. SOCIOECONOMIC COMMITMENTS

- Due to the large amount of ongoing and planned coal-related construction activity, western North Dakota is likely to continue experiencing the adverse effects of rapid resource development typical in sparsely populated areas.
- Despite the adverse affects, there has been little local opposition to development in those areas where federal leasing, lignite mining and power plant construction has occurred in the past (i.e., Mercer, Oliver and McLean Counties).

The western region of North Dakota already produces more energy in the form of electricity than can be consumed within the state. Considering only the level of expansion already permitted, over 90% of all future energy extracted and processed will be transmitted for consumption outside North Dakota. A major reason for the expansion of electricity generating capacity in the western portion of the state is the distribution of population, and thus the political influence, on decisions concerning energy development. Most of the state's industry and population are located in eastern North Dakota, an area that, while enjoying the benefits of an enlarged tax base and reliable energy supplies, will not be affected by the negative consequences of energy development.[1]

Due to the large amount of ongoing and planned coal-related construction activity, western North Dakota is likely to continue experiencing the adverse effects of rapid resource development typical in sparsely populated areas. The influx of hundreds, and in some cases thousands of workers required for the construction of coal-fueled facilities at various sites will produce dramatic changes in social conditions. Health, education, police, fire protection, road and waste disposal services may rapidly become inadequate, especially in the towns of Beulah and Hazen. The resources of these two communities are already strained due to their location near construction of the Coyote I power plant, the Antelope Valley Station power plant, and the Great Plains Gasification Project. In these and other small communities, industry competition for the limited supply of labor will result in higher wages and localized inflation. People on fixed incomes may either be forced to lower their living standards or move to towns far away from energy development.[2]

Some factors have softened the impacts of energy-related development. Energy developers in the Beulah area have pooled resources in order to provide housing for incoming workers. Also, the cities of Bismarck and Mandan, located within an hour's drive of the major lignite developments, have absorbed some of the population influx. In addition, North Dakota has imposed a coal severence tax based on a sliding rate derived from the federal government's cost of living index. This tax is designed to provide funds to local governments affected by energy development. However, not all of the revenues collected are distributed to impacted communities. A greater proportion of the tax is divided up and either distributed to county governments, placed in the state general fund, or invested to avoid the boom-bust phenomenon often associated with western energy development. Severence taxes for North Dakota lignite were 96 cents per ton in January of 1981, or about 14.5% of the selling price of lignite at the mine. Recent attempts by midwestern Senators to limit severance taxes to 12.5% have become part of a regional conflict between the west and midwest.[3,4,5,6]

Despite many of the adverse socioeconomic effects associated with lignite development, there has been little local opposition to industry expansion in those areas where lignite mining and power plant construction has already taken place (e.g., Oliver and Mercer counties). A recent survey found that the population of Oliver County was much more in favor of energy development than other less developed counties. In the table below, results of a survey show a direct correlation between the extent of past development and favorable attitudes towards development.[7,8]

TABLE IV-1

GENERAL RESIDENT ATTITUDES TOWARD COAL DEVELOPMENT, 1976-77
"At the present, how do you feel about developing
coal industry in this area?"

County	Totally in Favor	Moderately in Favor	Neutral	Moderately Opposed	Totally Opposed
Dunn	6.1%	20.2	22.2	8.1	43.4
McLean	12.9	39.8	25.3	14.0	8.1
Mercer	16.8	35.1	22.9	17.6	7.6
Oliver	27.5	40.0	15.0	10.0	7.5
Farm	5.1	30.5	23.4	16.8	24.4
Non-Farm	20.5	37.1	22.8	10.8	8.9
Total rural county sample	13.8	34.2	23.0	13.4	15.6

SOURCE: Ludtke 1977 and REAP Socio-Economic Monitoring Project 1977.

NOTE: Ludtke surveyed four rural counties. REAP Socio-Economic Monitoring Project surveyed three urban counties.

The significance of the responses of residents of Oliver, Mercer and McLean Counties, each having a favorable attitude towards development, and Dunn county, where over 43% of the residents were "totally opposed" to future development has already had an impact on industry's siting plans outside of the three developed counties. The combination of public opposition to the siting of Natural Gas Pipeline Company's (NGPL) planned gasification facility in the Dunn Center area and the lack of available air quality increments at Theodore Roosevelt Park and financing all may have played a role in NGPL's decision to abandon the project. To date, no large coal related facilities have been located in the immediate vicinity. Several reasons account for Dunn County's opposition to development. Most of the private surface mining rights in Dunn County (and for that matter, the state as a whole) were leased by coal mining companies in the early sixties when the market, and thus the price of coal was depressed. Since then, inflation has increased the price of coal, making development more economically attractive to the mining companies. From the landowner's perspective, however, inflation has simultaneously increased the surface value of their property while severely eroding their potential return on the agreements that they negotiated with the coal companies many years earlier.[9]

Another aspect of the problem is that much of the lignite in the area is unleased federal coal. Thus, many local residents would gain little economic benefit from coal extracted from below their properties. Faced with few positive economic incentives to encourage development, Dunn County residents have become one of the most important anti-development groups in the state. With the surface ownership veto provisions of SMCRA (Section 714) concerning development of unleased Federal coal, local residents are likely to be the greatest constraint to synfuels development in the Dunn-Center area. Their influence is heightened by support from the Native American population located on the Fort Berthold Indian Reseration directly to the north of NGPL's former site. Despite the opposition, Nokota Industries has again proposed siting of a synfuels facility in the area. In fact, Nokota waited only a month after NGPL pulled out of the project before announcing its plans to construct a coal to methanol mine-mouth facility. Conflicts between Nokota and the Dunn Center populace will remain a secondary issue to Nokota if the company is unable to obtain a construction permit due to unavailable air quality increments. At this time, however, no federal coal has been leased in the Dunn Center area and the question of socioeconomic impacts does not appear likely to affect development of any of the federal coal already leased in North Dakota.[10]

B. LIGNITE TRANSPORTION REQUIREMENTS

- All power plants currently under construction or planned in North Dakota are designed to consume lignite mined on-site or from nearby mines.
- Continued production at Knife River Coal Mining Company's Gascoyne Mine and the future development of their New Liepzig project area are dependent on resolving transportation issues.

As pointed out throughout this report, the characteristics of lignite render its transportation by rail both difficult and costly. Difficulties with shipping lignites forced operators of the Big Stone Power Plant in South Dakota to design and build special covered hopper cars for shipping lignite to their power plant. The lignite is shipped from Knife River Coal Mining Company's Gascoyne Mine located 350 miles away. Along with the hopper cars, specialized loading and unloading facilities also had to be designed and built. With the exception of the Big Stone facility, no other operating power plant consumes more than a million tons of North Dakota lignite annually from mines located more than 100 railroad miles from the end use site. Furthermore, all of the power plants currently under construction in North Dakota or on the drawing boards are designed to consume lignite produced on site. Thus, any transportation constraints that would affect the production of lignite leased from the federal government would be associated only with those existing lignite consuming facilities requiring rail shipments from North Dakota. As it turns out, continued production of Knife River's Gascoyne Mine and the future development of their New Leipzig project area are dependent on resolving transportation issues.[11]

The track serving both the Big Stone Power Plant and the Gascoyne Mine is owned and operated by the Chicago, Milwaukee, St. Paul and Pacific Railroad (Milwaukee Road). About 350 miles of Milwaukee Road track provide an avenue for two daily unit train deliveries to the power plant from Gascoyne. If the integrity of the track is not maintained, both the mine and the power plant would be forced to close down. The Milwaukee Road is bankrupt and is currently under the jurisdiction of the Federal Bankruptcy Court. The railroad company has already amputated the portion of its system west of Miles City, Montana and, according to operators of the power plant, the possibility of severing further trackage including all services west of Minneapolis-St. Paul is very real. Recently, the Milwaukee Road Trustee requested a new freight rate, which would increase the price of transporting the lignite to the power plant by 65 percent. The Big Stone partners found this unacceptable since the railroad trustee was unwilling to make any assurances that any portion of the higher rate would be used to maintain the roadbed between the mine and the power plant.[12]

Various measures have been taken to improve the 350 mile section of track which is considered to be in worse shape than any other stretch of track still maintained by the railroad. While attempts are being made to reorganize the railroad company's management structure, both the states of

North Dakota and South Dakota are spending funds allocated to them under the U.S. Railroad Recovery Act to maintain that track in operating order. Even if the Milwaukee Road abandons the track, another rail company could possibly pick up its control. Both Burlington Northern and Union Pacific have taken responsibility for some of the western tracks dropped by the Milwaukee Road.[13]

While production at Knife River's Gascoyne operation has not, at least up to this time, been affected by inadequate rail service, development of the company's New Leipzig project area containing 2,498 acres of federal coal has been delayed indefinitely due to an inability to transport coal from the potential mine site. As Knife River originally planned, markets currently served by its South Beulah mine were to be supplied by the New Liepzig project once the Coyote I mine-mouth power plant in Beulah was operational. The New Liepzig mine would produce around two million tons of coal per year to be consumed at MDU's Heskett #1 and #2 units located in Mandan, North Dakota (approximately 0.6 million tons/year), Otter Tail Power's Hoot Lake power plant in Fergus Falls, Minnesota (approximately 0.7 million tons/year), and various small industrial consumers. South Beulah mine production was then to be directed towards fulfilling requirements of the new mine-mouth power plant.[14]

Problems concerning development of the New Liepzig project arose during Knife River's negotiations with Burlington Northern over the costs of upgrading the roadbed between the New Liepzig area and Mandan. The line, as it stands today, is designed only to carry light traffic. In order to carry coal from the mine property, the track must be upgraded at a cost of somewhere between 20 and 24 million dollars, including the price tag for a one and one half mile spur track. Burlington Northern is unwilling to expend the capital required for the upgrading and has suggested that, if it wishes, Knife River can put up the capital for upgrading the line. Knife River, would have difficulty in raising this much capital and believes that the costs should be prorated between the two organizations since Burlington holds extensive mineral rights along the expanse of the track in question.[15]

Even if the volume of coal that would be shipped by rail from the New Leipzig area was of sufficient quantity to make upgrading of the track an economically viable proposition, under existing circumstances Burlington stands to gain little from the investment. At this time, Burlington already has the contract to deliver coal that would be coming from New Leipzig but is now being produced at Knife River's South Beulah mine. Knife River has no alternative to shipping the coal via Burlington Northern at either site. In response to this problem, Knife River has been forced to expand its production at the South Beulah mine in order to meet requirements of both its current lignite customers and the Coyote I facility. Knife River is still attempting to negotiate with Burlington but plans for development of the New Leipzig area are up in the air.

C. CONFLICTS WITH OTHER RESOURCE DEVELOPMENT ACTIVITIES

- Although mining activities associated with the extraction of oil/natural gas are a significant distance from lignite mining operations, ultimate use of both resources is dependent on the building of gas sweetening plants and coal conversion facilities in an area where both must compete for sulfur dioxide Class I increments at Theodore Roosevelt National Park.

With the exception of oil and gas developments to the west of Mercer and Oliver Counties, significant conflicts of interest are not likely to arise over the extraction of lignite at the expense of other minerals. Significant oil and gas exploration is taking place along the western edge of the state, but oil and gas operations are well removed from existing federal lease areas. Although mining activities associated with the extraction of oil/natural gas are a significant distance from lignite mining operations, ultimate use of both resources is dependent on the building of gas sweetening plants and coal conversion facilities in an area where both must compete for nonexistent sulfur dioxide Class I increments at Theodore Roosevelt National Park.[16] (See Chapter II)

If Class I increments are determined to be available at a later date, the future of additional coal conversion plants may still be limited by potential oil and gas developments. This would especially be the case for any coal conversion facilities that have not already filed applications for construction permits since two gas sweetening facilities--one an addition to Warren Petroleum's existing facility and another larger facility planned by AMOCO may consume any available increments due to their close proximity to the park. Applications for construction permits have been filed for both of these facilities. While oil and gas development can move at a rapid pace, many years go into the engineering and design of coal-fueled plants before a permit to construct application can be filed with the state. The existing Warren Petroleum plant was processing 15 million cubic feet of gas within one year of filing its permit application. If gas containing hydrogen sulfide continues to be found in new wells around the Class I areas, any future allowable sulfur dioxide increments may be consumed before additional coal conversion plants are designed and their permit to construct applications are filed. This is another factor which would make it appear that mine-mouth utilization of lignite in North Dakota may reach a peak when those facilities that have unapproved applications are permitted--that is if they are permitted at all.[17]

REFERENCES

1. John Norton, Dakota Resources Council. Interview comments, September 1980.

2. Ibid.

3. Gene Christiansen, North Dakota Department of Health. Interview comments, September 1980.

4. Ed Englerth, North Dakota Public Service Commission. Interview comments, September 1980.

5. Energy ERA Newsletter. "ND Coal Tax Now 96¢ a Ton." Bismark, North Dakota, January 31, 1981.

6. Energy ERA Newsletter. "Bill Limiting Severance Tax Introduced in U.S. Senate." Bismark, North Dakota, February 1981.

7. John Norton, op. cit.

8. U.S. Department of the Interior, Bureau of Land Management, *Draft West-Central North Dakota Regional Impact Statement on Energy Development.* January 1978.

9. John Norton, op. cit.

10. Ibid.

11. Alan Mace, Knife River Coal Mining Company. Interview comments, September 1980.

12. Energy ERA Newsletter, "Milwaukee RR May Abandon Minnesota-to-Montana Line," Bismark, North Dakota. January 31, 1981.

13. Ed Englerth, North Dakota Public Service Commission. Interview comments, September 1980.

14. Alan Mace, op. cit.

15. Ibid.

16. U.S. Department of the Interior, op. cit.

17. Ibid.

CHAPTER V: ASSESSMENT OF UNDEVELOPED FEDERAL COAL LEASES IN NORTH DAKOTA

A. DESCRIPTION OF THE TECHNICAL SCREENS

This chapter presents the methodology, analysis and results of OTA's assessment of the development prospects of undeveloped federal coal leases--those leases not included in a pending or an approved mining plan. OTA developed two types of criteria or "screens", to evaluate the production potential of these undeveloped leases. The primary screens are used to analyze the geotechnical qualities of the leases. These screens are based on criteria a prudent coal operator would use to determine whether or not a coal property had sufficient value to warrant development efforts during the next ten years. To pass OTA's primary screens, a lease must have the following characteristics:

1. The tract must form a viable mining unit (be compact and contiguous).

2. The tract must have sufficient reserves to support a mine.

3. The coal must be of suitable quality for current or potential users.

4. The coal seam(s) must be sufficiently thick to be economically mineable and the stripping ratio must not be too high.

OTA's second set of screens were designed to evaluate the influence that institutional, environmental and infrastructure factors will have on the development of a lease. These secondary screens examine production prospects from the standpoint of both the lessee's experience and capability to mine the property in question, and the effects that transportation, environmental regulations, market conditions and legal issues will have on the development prospects of the lease. Table V-3 describes the rationale and sources utilized in formulating the screening criteria presented in Tables V-1 and V-2.

Table V-1 and Table V-2 summarize the primary and secondary screens established by OTA for the North Dakota assessment. Due to several unique features of the federal coal leases in this state, the results of applying the primary screens (Table V-2) in this report differ from those generated in OTA's study of other states. Unlike these other states, the federal leases in North Dakota are rarely contiguous units or contiguous with one another. On the contrary, a single lease is often divided into several separate tracts interspersed with fee coal. For this reason, a company rarely acquires a federal lease in North Dakota when it does not control mining rights of the surrounding coal property or lease sections.

Another unique feature of coal development in North Dakota, unlike the other states in OTA's assessment, is that the minimum reserves required for mine development are rarely found on any one North Dakota lease. In North Dakota this pattern is the rule, not the exception. Furthermore, heat content of the lignite tends to be irrelevant in an operator's decision whether or not to invest in the development of a mine in North Dakota. As explained in Chapter I the quality of lignite coal is not a major factor in its end use. Last, it is important to note that two of the undeveloped leases in North Dakota contain reserves of leonardite, a highly oxidized form of lignite which is processed into a drilling mud additive. The technical screens presented in Table V-I do not apply to the development of leonardite.[1,2]

TABLE V-1
KEY TO FILLING OUT LEASE BLOCK SUMMARY SHEETS

Primary Screens (Geotechnical Factors)

1. Does the lease tract form a compact and contiguous unit, or if individual leases in the tract do not share any boundaries, are they separated by fee or state coal that can be presumed to be part of a logical mining unit (LMU)? __+__ yes __-__ no

2. Does the tract have sufficient recoverable reserves to supply a 400 MW mine mouth power plant at a rate of 2 million tons/year for 30 years (60 million tons) or a synthetic fuels plant at a rate of 10 million tons/year for 30 years (300 million tons)? __+__ yes __-__ no

3. Does the coal in the tract meet the following coal quality standards? (Values on an as received basis): __+__ yes __-__ no

End Use	Reserves (10^6 tons)	Btu/lb	Ash (%)
Electric Power Generation	60	6,000	10
Synthetic Fuels	300	6,000	10

4. Do the geologic characteristics of the coal reserves or topographic conditions impose any unusual restrictions on mine design or coal recovery, and are the following seam thickness and overburden requirements met? __+__ yes __-__ no

Average Seam Thickness	Maximum Stripping Ratio*
4 feet	
4 to 10 feet	15 to 1

*Lignite is not generally mined at depths greater than 120 feet.

TABLE V-2

Secondary Screens (Institutional and Environmental Factors)

1. Ownership Factors

    a. Does the lessee have the coal mining experience and financial capability to develop the lease (minimum capital requirements of ___ to ___ million for a surface mine producing at a rate of 2 million tons per year)? __+__ yes __-__ no

    b. Is there evidence of significant exploration or baseline environmental studies at the site? __+__ yes __-__ no

2. Transportation Factors. Is the tract near (within 20 miles) of existing or proposed rail lines? __+__ yes __-__ no

3. Environmental Factors. Are there any known environmental problems at the site? __-__ yes __+__ no

4. Legal/Institutional Factors. Are there any known legal or institutional problems that might constrain development? __-__ yes __+__ no

TABLE V-3. SCREENING PROCESS RATIONALE FOR UNDEVELOPED FEDERAL COAL LEASES

CRITERIA	RATIONALE	REFERENCES	INFORMATION SOURCES
All leases in the tract are held by the same owner, or two or more owners with the same organizational/decision-making structure.	Coal operators form mining units out of more than one lease—leases held by the same owner(s) in the same area are presumed to have been acquired for purposes of development. Regulations require that all leases in a logical mining unit (LMU) be under the effective control of a single operator.	DOI Coal Leasing Regulations 43 CFR 3500.0-5(d) 43 CFR 3520.2-6	Lease lists with ownership and location obtained from State and District BLM Offices and DOI coal lease data systems (ACLDS).
The lease tract forms a compact and contiguous unit or is adjacent to land leased or owned by the lessee.	Mining units must be sufficiently compact and contiguous to allow for economy of of operation and orderly sequence of mining. Regulations require that all leases in an LMU be contiguous - i.e., having at lease one point in common.	DOI Coal Leasing Regulations 43 CFR 3500.0(d)	Official public land records, coal plat maps from the District BLM office and coal lease maps at various scales from USGS, BLM, and State agencies.
The lease tract has sufficient recoverable reserves to support an average new mine. Steam: 2 million tpy - 30 year life - 60 million tons Synfuels: 10 million tpy - 30 year life - 150 million tons	Unless the lease tract is developed as a small mine or as part of an LMU on adjacent property, these recoverable reserves are required for the lessee to to amortize investment and recover costs.	CSMRI mine survey and profile of typical new mine requirements; consultations with USGS, BLM, and coal industry sources.	Recoverable and in-place coal reserve estimates from USGS, BLM, coal industry sources, State and Federal government reports and OTA calculations.
Coal reserves meet minimum coal quality standards for expected end use. Steam: Surface Minimum BTU lb: 6,000 Maximum Ash Content: 10% Maximum Moisture: 45%	The coal quality standards used in this report reflect the relatively low quality of lignite currently consumed in North Dakota. Unlike other areas, coal quality is not the most important concern of a prospective user of lignite in North Dakota.	CSMRI mine survey and profiles of typical new mine requirements; consultations with USGS, BLM and coal industry sources.	Coal quality information from DOI coal lease data systems and other USGS sources, F.E.R.C report summaries published in Coal Outlook, Keystone Manual, and coal industry sources.
Leonardite: Not applicable	Used as an additive to drilling mud, the quality of these oxidized lignites is of no significance.	Consultations with USGS, State and leonardite processors.	Keystone Manual, West Central North Dakota EIS (BLM)

TABLE V-3 (continued)

CRITERIA	RATIONALE	REFERENCES	INFORMATION SOURCES
Geological characteristics of the coal reserves and topographic conditions do not impose restrictions on mine design or resource recovery. Steam: Surface Max Overburden: 120' Min Overburden: 20' Min Seam Thickness: 10' Max Seam Dip: 6° Leonardite: Surface Max Overburden: 50' Min Overburden: n/a Min Seam Thickness: 4' Max Seam Dip: 6°	Geo-technical requirements for mine design and equipment make mining under certain conditions difficult and costly and limit recoverability. Lignites with with greater than 150' of overburden are are not likely to be recovered in the near-term. Coals with an overburden of less than 20' thick are usually oxidized and useless as a fuel.	CSMRI mine survey; consultations with USGS and industry sources.	Geologic information from DOI automated coal system, Keystone Manual; State Geological Survey Monographs and industry sources.
Lessee has financial capability and/or mining experience to develop the tract. In North Dakota, initial capital costs (1980 dollars) to open a new 2 million ton/year surface mine are estimated at ____ million.	Demonstrated mining ability and financial resources to support the initial capital costs of mine development in North Dakota are important indications of a lessee's intent to mine coal from federal lignite leases.	DOE Energy Information Admin., consultations with USGS and industry sources.	OTA study of federal leaseholders, including information on individual and corporate lessees, current and past mining experience, and assets based on lessee disclosure statements in lease records, state corporation commissions, industry directories, direct interviews with lessees and coal industry sources, and investment services. Ownership information on file with BLM, extracted and summarized by OTA contractor and supplemented by independent research and direct contacts with lessees.

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[*] This criteria provides, at best, a rough measure of the financial capability required for mine development in North Dakota. In practice, the estimated figures will vary according to the geologic and topographic conditions that prevail at the mine site and the types of facilities and equipment that will be used for coal production. The figures in this report include the cost of a new preparation plant.

B. Summary of Undeveloped Lease Assessments

There are eight undeveloped lease blocks in the Fort Union Region. Based on OTA's analysis, only one of these lease blocks has favorable production prospects, two have uncertain prospects, and five have unfavorable prospects. Of the five with unfavorable development prospects, two (Leroy Bonsness and Consolidation Coal's Velva Mine) were actually mined out before passage of the Surface Mine Control and Reclamation Act; for consistency with OTA methodology they were classified as undeveloped. They are therefore omitted from the discussion below. (See Table V-4.)

TABLE V-4
SUMMARY OF UNDEVELOPED LEASE ASSESSMENTS

Block #	# of Leases	Owner/Mine Name	Prospects for Development	Prospects for Production	
				By 1986	By 1991
1	1	American Colloid	Unfavorable	Unfavorable	Unfavorable
4	1	Consol/Renner's Cove	Unfavorable	Unfavorable	Unfavorable
5	1	Consol/Velva*	Unfavorable	Unfavorable	Unfavorable
7	1	Coteau Properties/ Beulah-Hazen	Uncertain	Unfavorable	Uncertain
9	1	Geo Resources/ Nelson Pit	Favorable	Favorable	Favorable
11	2	KRCMC/New Leipzig	Uncertain	Unfavorable	Uncertain
13	1	Leroy Bonsness*	Unfavorable	Unfavorable	Unfavorable
15	2	U.S. Steel	Unfavorable	Unfavorable	Unfavorable

The one lease block likely to be in production by 1986 or 1991 is held by Geo Resources, Inc.

Three of these lease blocks (American Colloid, Consolidation Coal Company's Renner's Cove and the U.S. Steel block) have poor development and production prospects. The low potential for production from these leases is linked to the lack of an identifiable market for their lignite. As discussed in earlier sections, lignite sales in the past have been restricted to purchases by consumers located within several hundred miles of the Fort Union lignite fields. Due to the high cost of transporting lignite in relation to its low Btu content per pound and its poor handling characteristics, the development of markets for lignite far beyond the Fort Union area is not likely.[5]

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*These leases were mined out before passage of the Surface Mine Control and Reclamation Act of 1977. However, they are classified as undeveloped since no mine plan was submitted with the Office of Surface Mining.

Given this constraint, the three lease blocks with unfavorable development prospects are not likely to produce lignite unless local markets are identified. U.S. Steel's tentative plans for supplying lignite to a mine-mouth synthetic fuels plant would likely be prevented by competition for water rights. An already highly restrictive allocation system associated with Montana's Yellowstone River System may preclude siting a facility with such large water requirements. The two leases could possibly be used to fuel a conventional coal-fired steam electric plant. However, there is no evidence of plans to construct such a facility. Given the long lead times required to design and construct a power plant and the recent decline in demand for electric power, development prospects for these leases are poor.[6]

Prospects for developing Consolidation Coal Company's lease in the Renner's Cove area are also low. The inability to locate a market for lignite from this lease is also the major issue affecting its production potential. The potential siting of a mine-mouth coal conversion facility on the lease may not be possible due to air quality constraints.

Development of Knife River Coal Mining Company's New Leipzig leases has been delayed for another reason. Lignite from these two leases was to be shipped by rail to two existing power plants currently supplied by Knife River's South Beulah mine. However, the rail line currently serving the New Leipzig area is not designed to carry heavy unit train traffic. The cost of upgrading the tract is estimated at 20 to 24 million dollars. At this time, neither Knife River or Burlington Northern are willing to commit their capital resources to upgrading the track. While upgrading of the track doesn't appear likely, it is still possible that a coal conversion facility could be located at the site. Unlike the Renner's Cover area to the north, prospects for the New Leipzig project may not be affected by air quality constraints. The State Department of Health has not determined if a power plant located at the New Leipzig area would impact daily concentrations of sulfur dioxide at Theodore Roosevelt National Park. The park, designated as a Class I air quality area, may no longer have any available daily sulfur dioxide air quality increments for those days when winds are blowing from east to west. Thus, construction permits may not be granted to power plants planned for siting in Mercer and Oliver Counties (to the north of New Leipzig). If utility operators still wish to site power plants in the state, they will have to find an alternative location. New Leipzig could be such an alternative if the utility can show that the combined effect of emissions from the new source, and the permitted emissions emanating from Mercer and Oliver counties, will not exceed air quality standards at the park. If either the transportation or air quality issues are resolved, development prospects for New Leipzig would be high. As it stands, prospects for development have been classified by OTA as uncertain.[7,8]

Two of the undeveloped North Dakota leases contain reserves of leonardite, a highly oxidized form of lignite which is processed into a drilling mud additive. The demand for the leonardite additive has been growing with increased offshore drilling activity along the coasts of the Gulf states and California as well as locally in North Dakota. Geo Resources, Inc., which holds one of the leonardite leases, appears likely to proceed with development of its federal holdings. Mining operations are in place on lands adjacent to the lease area and Geo Resources should be mining federal coals in five to ten years. In the meantime, Geo Resources is in the process of developing a mine plan application which includes the federal acreage in a logical mining unit. The application should be filed within the next year. By including the federal lease in a logical mining unit, Geo Resources will be able to continue mining private coals and still meet diligence development requirements associated with the federal lease area.[9]

Development of the second leonardite lease is not very likely. This lease is held by American Colloid and is located near the Geo Resources lease area. Like Geo Resources, American Colloid has a leonardite processing plant. But American Colloid's plant, located far to the south of the lease area, is currently supplied with leonardite by the nearby Knife River Coal Mining Company's Gascoyne mine. Since there is no evidence to suggest that American Colloid is planning to build an additional processing plant near their lease, development of the federal leonardite appears unfavorable.

Prospects for production from the undeveloped Coteau Properties Company lease (Lease Block No. 7) appears relatively uncertain. The lease is located in Coteau's Beulah-Hazen mine area. The mine is being designed to fuel a large complex of coal conversion facilities including what may be the nation's first commercial-scale coal gasification plant. If both the power plants and the coal to high-Btu gas facility are on line, Coteau will be under contract to supply between 7.2 and 9.8 million tons of lignite per year. Development prospects for the lease is uncertain due to its location within the mining area. The lease block in question is located well north of the areas planned for mining. Development of this lease is dependent on

Coteau's planned sequence of mining and whether the lease is included in a logical mining unit in Coteau's future mine plan applications.

A more detailed discussion of these undeveloped leases is found on the following Lease Block Summary Sheets.

REFERENCES

1. U.S. Department of the Interior Automated Coal Leasing Data System Printout dated September, 1980.

2. 1980 Keystone Coal Industry Manual. McGraw-Hill, 1980.

3. John Higgins, Consolidation Coal Company. Telephone interview comments. October 1980.

4. William B. Hansen, U.S. Geological Survey, Billings, Montana. Interview comments. September 1980.

5. 1980 Keystone Coal Industry Manual, op. cit.

6. Montana Leases Schmidt?

7. Alan Mace, Knife River Coal Mining Company. Interview comments. September 1980.

8. Gene Christiansen, North Dakota Department of Health. Interview comments. September 1980.

9. Ken Koenan, Geo Resources, Inc. Telephone interview comments. October 1980.

UNDEVELOPED LEASE BLOCK SUMMARY SHEET

Lease Block Name: AMERICAN COLLOID

Block No. 1

Owner/
Parent Co. American Colloid

County: Williams

State: North Dakota

Location: T154N, R100W

LEASE DATA

Lease Number	Acres	Reserves M Tons	Btu/lb.	Sulfur %	Sulfur #M Btu	Ash (%)	Seam thick. (ft.)	Overburden thick. (ft.-ave.)	Overburden ratio
M61025	80	In-place: Recoverable:	5458	1	1.83	10			
Total/ Average									

APPLICATION OF SCREENS

Primary Screens								Secondary Screens (+ favorable - unfavorable)					
LMU	Res.	Btu	S	Ash	Seam Thick.	Overburden Thick.	Overburden Ratio	Own.	Act.	Tran.	Geo.	Env.	Leg.
+	-	+	+	+	+	+	+	+	-	-	+	+	+

Development Prospects: Unfavorable If favorable, suitable for no steam (export) no steam (on-site) no synthetic fuels (on-site)

Production Prospects 1986: Unfavorable 1991: Unfavorable

COMMENTS:

The resources found on the lease are a highly oxidized form of lignite known as leonardite, which is used in the manufacture of lubricants for oil and gas well drilling operations. It should be noted that the coal quality criteria usually used in OTA's evaluation of the economic feasibility of recovering North Dakota lignites does not apply to the evaluation of leonardite reserves. For example, the fact that leonardite is so highly oxidized that it resists combustion is irrelevant in its applied use as a component of drilling muds. Rather, the factors that are important to consider in evaluating the lease's potential for production are its product market, the geotechnical characteristics of the mine site, reclamation concerns, and the applicability of state and federal regulations.(1)

Within this context, it is evident that the major factors affecting development of this lease are primarily economic. American Colloid, the holder of this lease, is a producer of both bentonite and leonardite, which it sells on national and international markets. American Colloid currently processes approximately 60,000 tons of leonardite annually. The leonardite is supplied from the Knife River Coal Mining Company's operations near Gascoyne, North Dakota, and hauled to American Colloid's processing plant located less than a mile away. American Colloid's 80 acre federal lease, on the other hand, is located many miles to the north of their processing plant, to which there is no direct transportation link. Thus, to develop this lease, American Colloid has two options: one, they could transport the leonardite to their existing processing facilities, or two, they could construct another facility at the lease site. However, American Colloid does not appear to be actively pursuing either alternative. In fact, American Colloid has only

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*Reserve estimates are from BLM's ACLDS and are considered too high by the company; however, they have no tonnage estimates of their own.

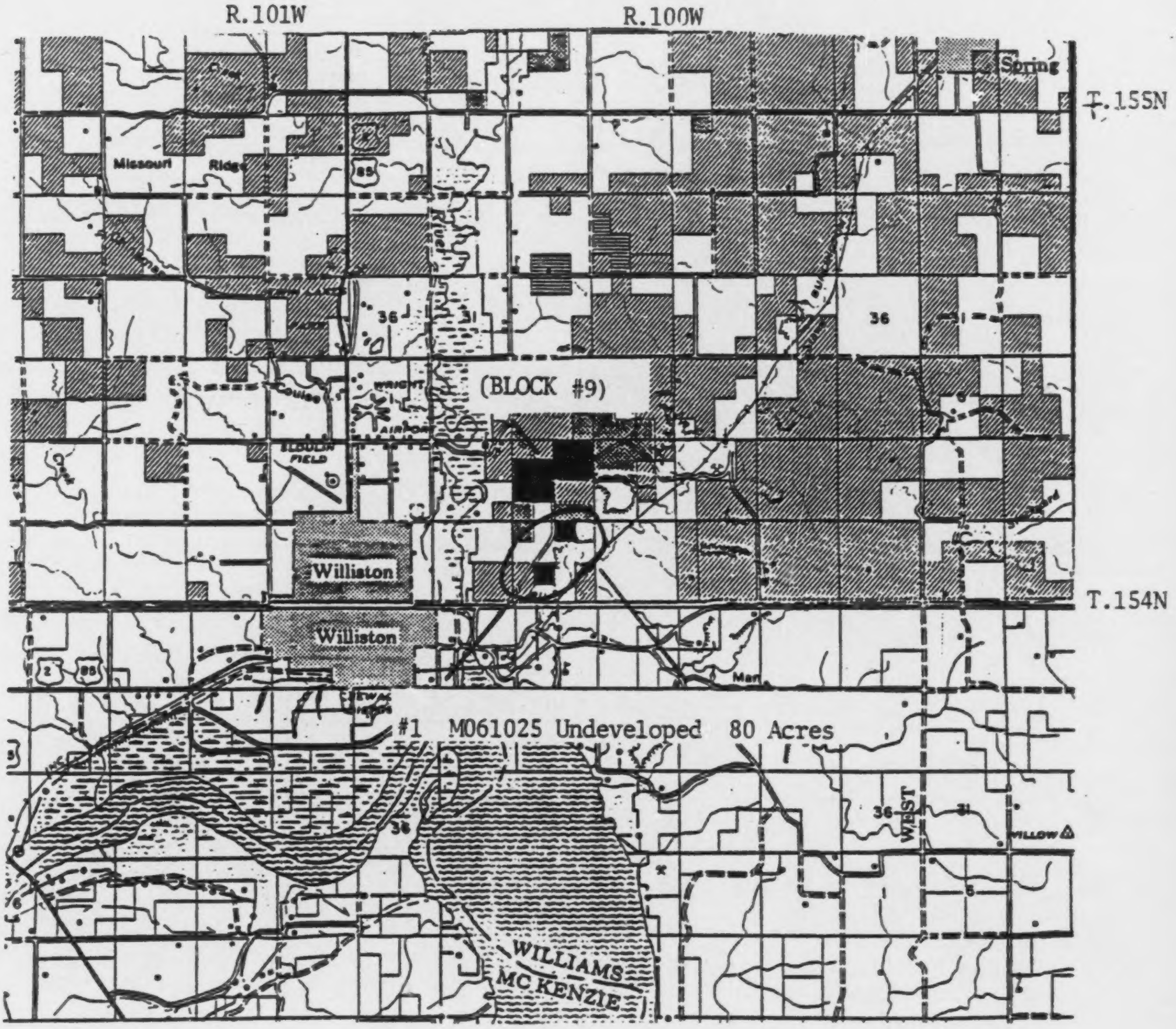
suggested that they plan to schedule exploration to estimate tonnages--a crucial first step in any development plan. Other preparatory mining activities, such as collection of baseline environmental data or transportation studies have not been initiated. The cost of transporting lignite to the Gascoyne plant probably outweighs the costs of opening a new processing facility. American Colloid's lack of development activity is also probably influenced by the fact that, at their current consumption levels, leonardite received from the nearby Knife River mining operations is estimated to meet their market requirements for the next fifty years.(2,3)

Thus, American Colloid has no real incentive to develop this lease and the overall prospects for production by 1986 and 1991 are unfavorable. These ratings could change if Geo Resources, Inc. expands production at its leonardite processing plant located within two miles of the American Colloid lease.

1. 1980 Keystone Coal Industry Manual. McGraw-Hill, 1980.

2. Boyd Klinger, Vice President Mining and Exploration, American Colloid. Telephone interview comments, October 1980.

3. Alan Mace, Knife River Coal Mining Company. Interview comments, September 1980.


R.101W
R.100W
Spring
T.155N
Missouri Ridge
85
River
36
31
36
31
(BLOCK #9)
Wright
Airport
Sloulin Field
Williston
Williston
T.154N
2
85
#1 M061025 Undeveloped 80 Acres
36
36
31
WEST
Willow
WILLIAMS
MC KENZIE

SCALE: 1/2 inch = 1 mile

MAP V-1

WILLIAMS COUNTY

BLOCK #1 AMERICAN COLLOID CO.

UNDEVELOPED LEASE BLOCK SUMMARY SHEET

Lease Block Name: Renner's Cove Project Block No. 4

Owner/ Parent Co. Consolidation Coal Company/ Continental Oil Company

County: Mercer Location: T146N, R88W
State: North Dakota

LEASE DATA

Lease Number	Acres	Reserves	Btu/lb.	Sulfur		Ash	Seam thick.	Overburden thick.	ratio
		M Tons		%	#M Btu	(%)	(ft.)	(ft.-ave.)	
M37829	332	Total = Mineable = Recoverable=	6689	0.69	1.03	7.73			
Total/ Average									

APPLICATION OF SCREENS

Primary Screens								Secondary Screens (+ favorable - unfavorable)					
LMU	Res.*	Btu	S	Ash	Seam Thick.	Overburden Thick.	Ratio	Own.	Act.	Tran.	Geo.	Env.	Leg.
+	+	+	+	+	+	+	+	+	+	+	+	+	+

Development Prospects: Unfavorable. If favorable, suitable for no steam (export) yes steam (on-site) yes synthetic fuels (on-site)

Production Prospects 1986: Unfavorable 1991: Unfavorable

COMMENTS:

This is a small lease made up of three discontinuous tracts of reserves bordering Lake Sakakawea and within close proximity to the Fort Berthold Indian Reservation. In and of itself, this lease contains far too little recoverable reserves to support establishment of a lignite surface mining operation. But combined with bordering fee lands where Consolidation Coal Company controls the mining rights, the Renner's Cove site is considered to have excellent mining characteristics and more than adequate reserves. Consolidation obtained this lease in a trade for massive tracts of land in the Renner's Cove area. The trade made with North American Coal Company's subsidiary, Coteau Properties Co., allowed the two mining companies to consolidate their respective holdings in the Renner's Cove area.

But, unlike Coteau Properties, Consolidation has no readily identifiable market for lignite produced from its Renner's Cove site. Possible prohibition of new power plant construction in the area could preclude establishment of a mine-mouth coal conversion facility anywhere in the immediate vicinity. If this becomes the case, Consol must find a market that is willing to purchase shipped lignite out of North Dakota or attempt to land a contract with a facility that has permission to construct in the area. Export of lignite to markets outside the region is limited to a couple of hundred miles due to competititon with higher quality Powder River Basin coals and lignites poor handling characteristics. The likelihood that a power plant will locate in Eastern North Dakota is poor since the state already produces more elecricity than it can consume (and even if a large generating facility did locate in this portion of the state, it would probably import higher quality coal from Montana or Wyoming rather than pay the high cost--on a per Btu basis--for lignite). Thus, prospects for development of an export market appear to be quite dim. Other possibilities include development of the Renner's

Cove area in order to make up for the production shortfalls at Consol's Glenharold Mine. Production at Glenharold dropped by over 900,000 tons during the period between 1978 and the end of 1979. Their inability to supply adequate quantities of coal to Basin Electric's mine-mouth Leland Olds plant caused the utility to buy coal produced at North American's Indian Head Mine (300,000 tons), as well as to purchase additional power from federally operated hydroelectric plants. But even a market for 900,000 tons of lignite doesn't warrant the capital expenditures required to open a new surface mining operation in North Dakota. The only other potentially viable market opportunity for lignite produced at Renner's Cover would be to augment Coteau Properties' production to fulfill demand for the two Basin Electric Antelope Valley Stations and the Great Plains gasification facility. While this proposition is feasible, Coteau has enough of its own reserves to fulfill lignite requirements for the three facilities and OTA was unable to find anyone willing to voice an opinion concerning the prospects of such an agreement. (2,3,4,5)

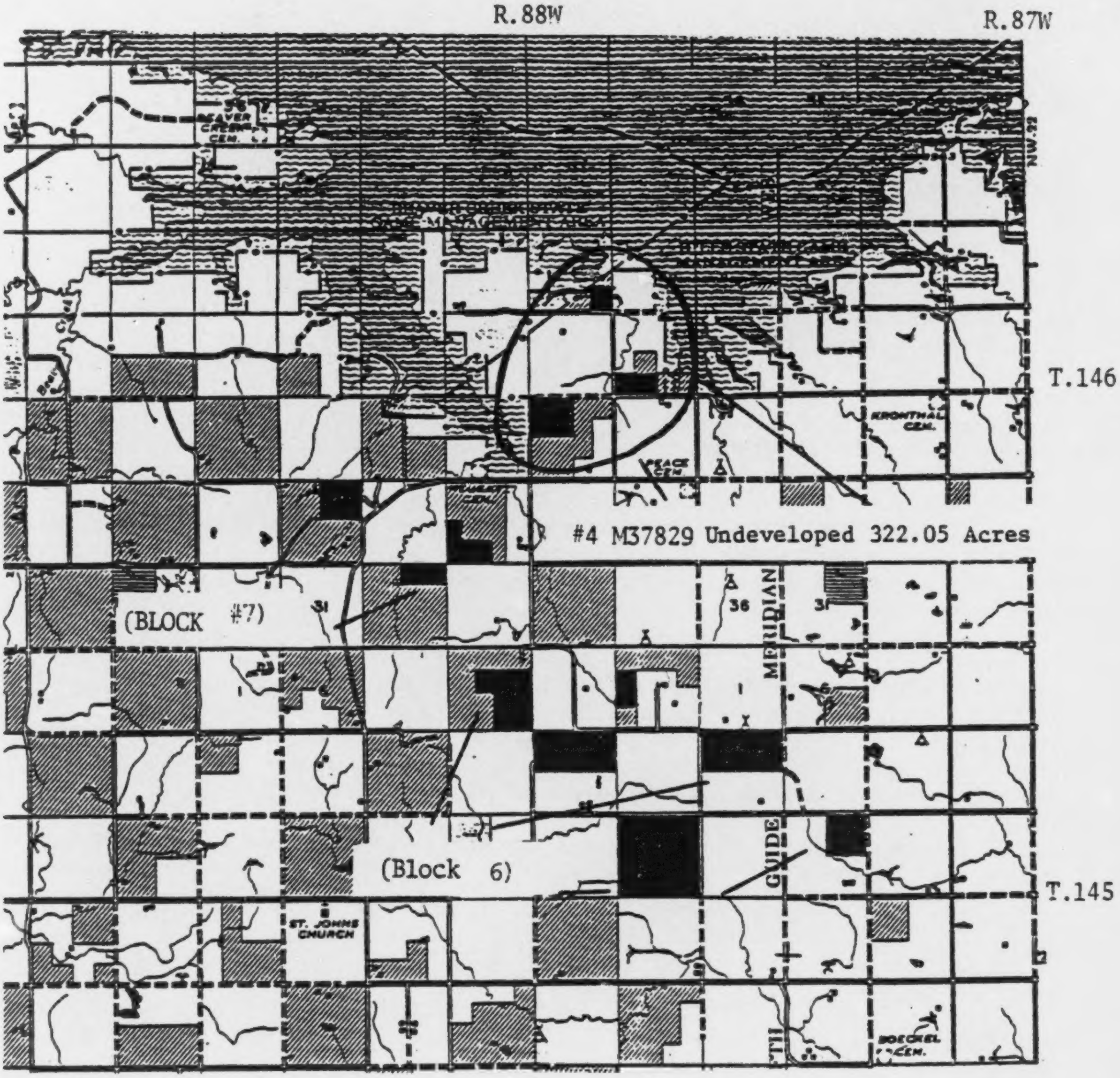
While Consolidation feels that the Renner's Cove area has extremely favorable mining characteristics, this may not be the case for the federal lease area which is located along the perimeter of the property. The proximity of the lease areas to marshlands, wildlife refuges and the Fort Berthold Indian Reservation could have prevented their eventual development even if Consol decided to construct a producing mine at Renner's Cove. Of the 320 acres of lease area, only 180 acres contain mineable reserves of lignite. Given the characteristics mentioned above, OTA's judgment is that the Renner's Cove lease will not be developed any time before 1991, if at all.

1. Tom Bobi, Kelly Eliason and Norman Osterman, Consolidation Coal Company, Bismark, North Dakota. Interview comments, September 1980.

2. Gene Christiansen, North Dakota Department of Health. Interview comments, September 1980.

3. Tom Bobi, op. cit.

4. Ed Englerth, North Dakota Public Service Commission. Interview comments, September 1980.


R.88W
R.87W
T.146
T.145
#4 M37829 Undeveloped 322.05 Acres
(BLOCK #7)
(Block 6)
BEAVER CREEK CEM.
KRONTHAL CEM.
PEACE CEM.
ST. JOHNS CHURCH
BOECKEL CEM.
MERIDIAN
GUIDE
36
31

SCALE: 1/2 inch = 1 mile

MAP V-2

MERCER COUNTY

BLOCK #4 CONSOLIDATION COAL CO./RENNERS COVE

UNDEVELOPED LEASE BLOCK SUMMARY SHEET

LEASE BLOCK: 5

MINE NAME: Velva Mine

LEASE NO: M15896(ND)

LOCATION: 10-15 miles southwest of Voltaire, North Dakota

LESSEE: Consolidation Coal Company; subsidiary of Continental Oil Company

SPECIFIC LOCATION: T152N, R81W

FIRST COAL SHIPPED: 1927

MINE LIFE: 10-20 years

1979 PRODUCTION: 300,000 tons

MINING METHOD: Strip

PROJECTED PEAK PRODUCTION: 300,000 tons/year

TOTAL PERMITTED ACREAGE: 1,181.2 acres

TOTAL DISTURBED ACREAGE: 600 acres

PENDING ACTIONS: Lease is awaiting reclamation after which the lease will be relinquished.

COAL DATA

RANK: Lignite

FEDERAL RESERVES:
IN PLACE: None

NAME: Coteau

RECOVERABLE: None

AVERAGE THICKNESS:

AVERAGE OVERBURDEN:

SEAM DIP: Less than 1°

OVERBURDEN RATIO:*

BTU/LB: 6,800

% SULFUR: 0.19

*Based on averages of seam thickness and overburden depths

NOTES:

0 Consolidation Coal Company has a contract to supply Basin Electric's William J. Neal Power Plant through 1990 with lignite extracted from its Velva Mine.

0 The small 40 acre federal lease tract was mined-out before 1977, thus no mine plan was ever filed with OSM.

0 Lease will be relinquished once the area has been reclaimed.

---

* This lease was mined out before passage of the 1977 Surface Mine Control and Reclamation Act. However, it was classified by OTA as undeveloped since no mine plan was submitted with the Office of Surface Mining.

VELVA MINE

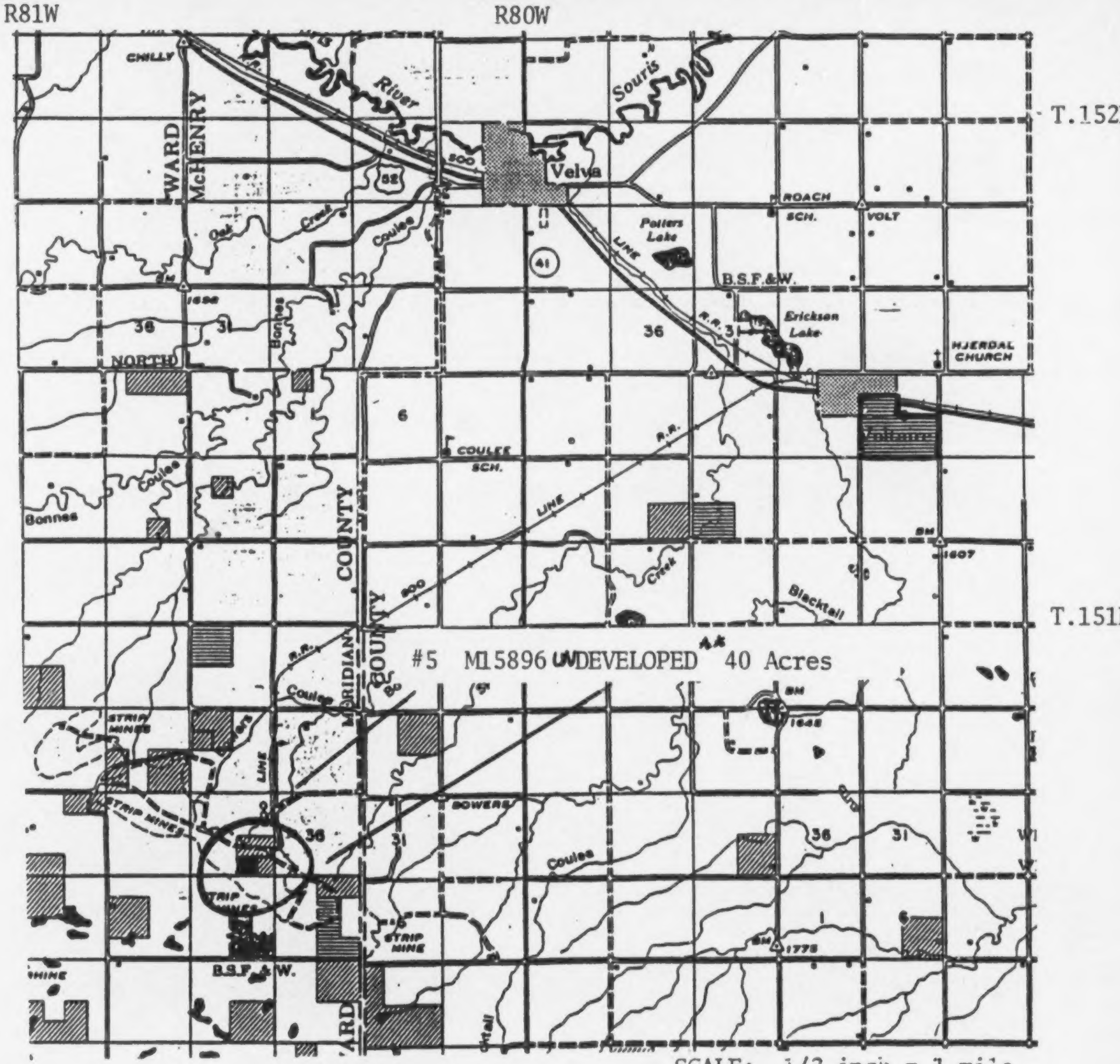
The Velva mine is located approximately 15 miles southwest of Voltaire in the northern portion of west-central North Dakota. The mine is owned and operated by the Truax-Traer Coal Division of the Consolidation Coal Company, a wholly owned subsidiary of Continental Oil Company. Coal was first mined from the Velva site in 1927. Currently, annual production ranges from 250,000 to 350,000 tons of lignite, depending on the market (i.e., the severity of the winter season). About 85% of the lignite produced is used to generate electricity at Basin Electric Power Cooperative's 42 MW William J. Neal Station. The lignite is transported by rail to the power plant which is located in Verendyne, North Dakota via a Soo Line railroad spur. The remaining 15% is sold to domestic and commercial users. Consol has a contract with Basin Electric to supply coal only until 1990 but Consol staff at the Velva operation expect the contract to be extended to 2000. If the generating station is phased out in 1990, the mine will cease production.[1,2]

The mine site is a relatively flat glaciated area. The occurence of a substantial volume of glacial till is characteristic of areas north of the Missouri River. Unlike the more sodic areas to the south, northern mines have the advantage of the chemically neutral glacial deposits which increase probability of a successful reclamation program.[3]

Mine equipment employed at the site includes one dragline, one loading shovel, three bulldozers, three front-end loaders, and seven haulage trucks. Fifteen acres of surface area are disturbed per year. Mining conditions include a relatively low overburden ratio (5:1) and a coal bed with a relatively imperceptible seam dip. Personnel at the Velva site feel that there is more than enough coal to supply the Neal Station generating facility for the next 20 years.[4,5]

Within the mine permit area, Consol holds a small (40 acre) federal coal lease. The lease (M15896(ND)) was granted in 1971 and subsequently mined out. Almost 160,000 tons of coal were extracted from the lease area. The lease area is still awaiting reclamation. Since the lease was mined out before passage of the Surface Mine Control and Reclamation Act of 1977, no mine plan was ever filed with the Office of Surface Mining. Once reclamation activities are finalized, Consolidation will relinquish the lease.[6,7]

1. U.S. Department of the Interior. Automated Coal Leasing Data System printout dated September 1980.
2. John Higgins, Consolidation Coal Company, Velva Mine Engineer. Telephone interview comments, September 1980.
3. U.S. Department of the Interior, Bureau of Land Management. Draft West-Central North Dakota Regional Impact Statement on Energy Development, January 1978.
4. U.S. Geological Survey, Billings, Montana. General Mining Order No. 1--Velva Mine.
5. John Higgins, op. cit.
6. U.S. Department of the Interior. Automated Coal Leasing Data System, op. cit.
7. John Higgins, op. cit.


R81W
R80W
T.152N
T.151N
CHILLY
WARD
McHENRY
River
Souris
Velva
500
52
Oak
Creek
Coulee
41
ROACH
SCH.
VOLT
Potters Lake
LINE
B.S.F.&W.
Erickson Lake
HJERDAL CHURCH
36
31
NORTH
Bonnes
6
COULEE SCH.
R.R.
LINE
Coulee
Bonnes
COUNTY
MERIDIAN
COUNTY
500
Creek
Blacktail
1607
1648
STRIP MINES
STRIP MINES
STRIP MINES
LINE
BOWERS
36
31
Coulee
36
31
STRIP MINE
1775
B.S.F.&W.
MINE
WARD

#5 M15896 UNDEVELOPED 40 Acres

SCALE: 1/2 inch = 1 mile

MAP __

WARD COUNTY

BLOCK #5 CONSOLIDATION COAL CO./VELVA MINE

**This lease was mined out before passage of the Surface Mine Control and Reclamation Act of 1977. Howver, it was classified by OTA as undeveloped since no mine plan was submitted with the Office of Surface Mining.

UNDEVELOPED LEASE BLOCK SUMMARY SHEET

Lease Block Name: BEULAH-HAZEN MINE Block No. 7

Owner/ Parent Co. Coteau Properties Company/ North American Coal Company

County: Mercer Location: 143N, R87W
State: North Dakota

LEASE DATA

Lease Number	Acres	Reserves	Btu/lb.	Sulfur		Ash	Seam thick.	Overburden thick.	ratio
		M Tons		%	#M Btu	(%)	(ft.)	(ft.-ave.)	
M163	400	Total = Mineable=	6855	0.19	0.28	5.33			

Total/
Average

APPLICATION OF SCREENS

Primary Screens								Secondary Screens (+ favorable - unfavorable)					
LMU	Res.	Btu	S	Ash	Seam Thick.	Overburden Thick.	Overburden Ratio	Own.	Act.	Tran.	Geo.	Env.	Leg.
+	+	+	+	+	+	+	+	+	+	+	+	+	+

Development Prospects: Uncertain If favorable, suitable for no steam (export) yes steam (on-site) yes synthetic fuels (on-site)

Production Prospects 1986: Unfavorable 1991: Uncertain

COMMENTS:

This lease (M163) and two others (M042819 and M071813) are all located in Coteau Properties Company Beulah-Hazen mine area. Portions of lease No. M071813 were included in Coteau's five year mine plan which was recently submitted with the company's mine permit application. Lease No. M042819 was included in Coteau's extended mine plan filed with the same application. The third lease (M163) is located north of the extended mine plan area and therefore has been classified as undeveloped, the two others are defined as developed and discussed in Chapter IV--Assessment of Developed Federal Coal Leases. While the three leases do not qualify as a single lease block under OTA's criteria, a majority of the factors affecting their development are the same. The following discussion will pertain to lease No. M163 for which no mine plan has been submitted.(1)

Pre-mining operations at the Coteau Properties Company Beulah-Hazen mine were initiated in 1978. The mine, which is located several miles north of Beulah, North Dakota, is being designed to fuel a large complex of coal conversion facilities including the nation's first commercial scale coal gasification plant. The operator, Coteau Properties Company, is a subsidiary of North American Coal Company. Once this mine and North American's Falkirk mine have both been expanded to full capacity North American will be the number one producer of lignite in the state.

Lignite initially extracted from the project area will be utilized to fuel the No. 1 and No. 2 units of the Basin Electric Power Cooperative's Antelope Valley Station. Due to a slump in the growth of electricity demand, associated in part with the depressed national economic situation, opening of the two units has been delayed until the spring of 1983 and 1985 respectively. Once they are in operation, the two mine mouth units will require a total of 5.2 million tons of lignite per year. All of this coal will be derived from the Beulah-Hazen mine. (3 4)

The mine will also be the source of fuel for the Great Plains Gasification Associate's commercial-scale coal to high-Btu gas conversion plant. The first unit, costing $1.5 billion, will use Lurgi gasifiers to convert 22,000 tons of low-grade lignite daily into 125 million cubic feet of high-Btu gas—the equivalent of 20,000 barrels per day of oil. While no pilot plant has been built in the U.S., consortium spokesmen contend that risks are minimal since prototypes of the proposed plant are already operating in South Africa. The consortium consists of American Natural Resources (Detroit), Peoples National Gas Company (Chicago), Columbia Gas Systems, Inc. (Wilmington, Delaware), and Tenneco and Trans Continental Cos., Inc. (Houston).(5,6)

When operational, the gasification project will require around 4.7 million tons of lignite annually from the Beulah-Hazen mine. Provided that it can retain its cogeneration commitment with Basin Electric, coal "fines", which would otherwise be a waste product in the gasification process, will be delivered to the power plant for the production of electricity. The coal fines will constitute 50 percent of the coal requirements of the Antelope Station facilities which will in turn supply electrical power to the coal gasification plant. Thus, when both 440 MW units and the coal to gas facility are on line, Coteau will be under contract to supply between 7.2 to 9.8 million tons of lignite per year. At these production levels, the Beulah-Hazen mine would be, by far, the largest coal producing mine in North Dakota. (7,8)

At this time, the Great Plains consortium plans to build another 125 mcf/day unit at the site. Construction on this second gasification unit would probably not begin until the first unit was proven to be operational (i.e., sometime after 1984). This second unit has already been reviewed by all the appropriate state agencies and has received all the permits necessary for construction. Providing that all obstacles to the development of the first facility can be overcome, and appropriate financial backing is available, the second unit could be on-line before 1990. The new facility would require 4.7 million tons of lignite per year. This would mean that production at the mine would range from 9.4 to 14.5 million tons of lignite annually, depending on Great Plains cogeneration arrangements with Basin Electric.(9)

Coteau has already been granted a permit to mine small portions of the project area by the Public Service Commission. The permit (No. 46) has been amended three times and allows for pre-mining activities and the mining of coal in and around the area where the lignite storage facilities and tipple are to be constructed.(10)

On January 31, 1980 Coteau filed a mine permit application with both the North Dakota Public Service Commission and the U.S. Office of Surface Mining. The application requested permission to mine portions of 2,146 acres. The application was subsequently amended, reducing the acreage to 1,240 acres of private fee coal and 160 acres of federal coal lands. OSM subsequently conducted a preliminary and final Apparent Completeness Review of the submitted application. This activity was finalized in September of 1980. Given the lead time required to have the permit reviewed and approved by the OSM solicitors office in Washington and to have the permit signed by the Secretary, it is unlikely that the permit will be granted before the end of 1980.(11,12)

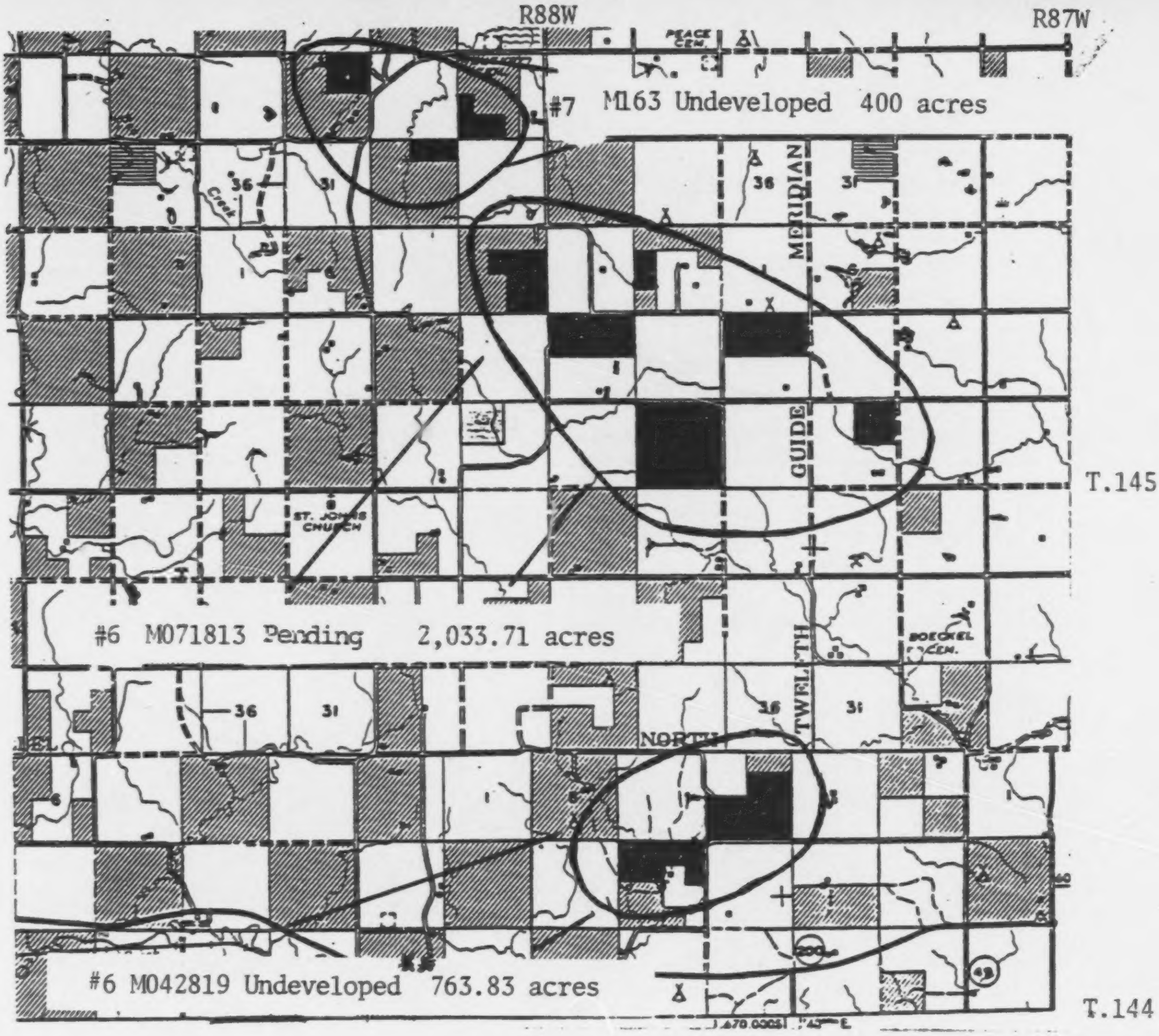
Future production levels at the Beulah-Hazen site will depend on the extent and timing of development of the various coal conversion facilities. It is probable lignite production will be used to fulfill the requirements of the Antelope Valley Nos. 1 and 2 units and the first gasification facility up until the late 1980's, at which time the second gasification unit would come on line. Thus, production should reach 7.2 million tons per year around 1985 and remain at that level until 1988 when it would be expanded to 10 or 12 million tons per year. Actual levels of production will depend on whether or not Basin Electric will agree to burn the coal fines generated by the gasification facility.

When and how much federal coal will be mined from the site will be based on timing and selection of mining sequence as determined by the mine design. Federal reserves of lignite currently held by Coteau account for a very minor portion of the total reserves (over 3 billion tons) controlled by the company. The mine is to be set up with four distinct pits separated by extensions of the Beulah trench. Only one 160 acre tract of one of the three leases is included in the current 5 year mine plan (M071813). Large portions of this lease are included within planned mining areas 3 and 4 and the 160 acre tract is planned as one of the first areas to be mined.(13,14)

Mine area No. 1 is the second of the mines to be opened at Coteau and it is quite probable that Coteau will develop the portion of M042819 contained within the planned mine area. This could be accomplished by starting production at the southern end of the mine area or by filing a mining application with this lease included in a logical mining unit. In either case, this lease is probably going to be mined in sufficient quantities to meet the DOI diligence requirements. (15)

The other lease area (M163) was obtained in a trade with Consolidation Coal Company. The transaction included both private and federal mineral holdings. This lease area is not included in the mine area presented in Coteau's extended mine plan. But, the high levels of production required to fuel both the power generating and coal gasification facilities could require expansion from those mine areas designated in the mine plan. If this is the case, production could be expected for Lease No. M163 by 1991 provided it is included in the additional areas to be mined. (16)

1. Coteau Properties Company, Surface Coal Mining Permit Application. 1980.
2. U.S. Office of Surface Mining. Initial Inspection Report, Coteau Properties Company. August 24, 1978.
3. The North Dakota Lignite Council. "Facts about North Dakota Lignite." 1978.
4. Energy ERA Newsletter, "ANG-Basin Electric Sign Power Supply Agreement," Bismark, North Dakota. October 31, 1980.
5. American Gas Association "Gas Update: Large-scale coal gasification begins in North Dakota." The Washington Post, August 28, 1980 (paid advertisement) pg. A-25.
6. The North Dakota Lignite Council, op. cit.
7. American Gas Association, op. cit.
8. Energy ERA Newsletter. "ANG-Basin electric Sign Power Supply Agreement." Bismark, North Dakota, October 31, 1980.
9. American Gas Association, op. cit.
10. Coteau Properties Company, Application for Permit to Engage in Surface Coal Mining Operations. North Dakota Public Service Commission, Bismark, North Dakota. January 23, 1980.
11. Ibid.
12. U.S. Department of the Interior, Office of Surface Mining. Apparent Completeness Review--Coteau Properties Company, Beulah-Hazen Mine. September 1980.
13. North American Coal Corporation, "We're Uncovering a 4.4 billion ton deposit in North Dakota." 1980 Keystone Coal Industry Manual (paid advertisement) 1980.
14. William B. Hansen, U.S. Geological Survey, Billings, Montana. Interview comments, September 1980.
15. Ibid.
16. Tom Bobi, Kelly Eliason, and Norman Osterman., Consolidation Coal Company, Bismark, North Dakota. Interview comments, September 1980.


R88W
R87W
#7 M163 Undeveloped 400 acres
MERIDIAN
GUIDE
Creek
ST. JOHNS CHURCH
#6 M071813 Pending 2,033.71 acres
TWELFTH
BOECKEL CEM.
NORTH
#6 M042819 Undeveloped 763.83 acres
T.145
T.144
36
31
200
49

SCALE: 1/2 inch = 1 mile

Map _

MERCER COUNTY

BLOCK #6 COTEAU PROPERTIES, INC./BEULAH-HAZEN MINE
BLOCK #7 COTEAU PROPERTIES, INC./BEULAH-HAZEN MINE

Undeveloped** = Associated with leases in mine plans

UNDEVELOPED LEASE BLOCK SUMMARY SHEET

Lease Block Name: Geo Resources Exploration, Inc. Block No. 9

Owner/Parent Co. Geo Resources Exploration, Inc.

County: Williams Location: T154N, R100W
State: North Dakota

LEASE DATA

Lease Number	Acres*	Reserves M Tons	Btu/lb.	Sulfur %	Sulfur #M Btu	Ash (%)	Seam thick. (ft.)	Overburden thick. (ft.-ave.)	Overburden ratio
M065329	320	Mineable: Recoverable:	5458	1	1.83	10			
Total/ Average									

APPLICATION OF SCREENS

Primary Screens								Secondary Screens (+ favorable - unfavorable)					
LMU	Res.	Btu	S	Ash	Seam Thick.	Overburden Thick.	Overburden Ratio	Own.	Act.	Tran.	Geo.	Env.	Leg.
+	+	+	+	+	+	+	+	+	+	+	+	+	+

Development Prospects: Favorable If favorable, suitable for no steam (export) no steam (on-site) no synthetic fuels (on-site)

Production Prospects 1986: Favorable 1991: Favorable

COMMENTS:

Geo Resources Exploration, Inc. acquired this 320 acre lease in 1964. The lease is located about 2 miles northeast of Williston, North Dakota. Resources found on this lease are a highly oxidized variety of lignite called leonardite. The mineral is not used as a fuel, but rather is processed into a compound of drilling muds used in petroleum exploration and extraction. Geo Resources currently has a mining operation near the lease area (Nelson Pit) as well as a leonardite processing plant in the Williston area. Recent increases in oil and natural gas exploration along the coasts of the Gulf states and California have provided Geo Resources with a steady market for its drilling mud product.(1,2,3)

Mining of leonardite at the Nelson Pit is a relatively uncomplicated small scale operation. Current production at the mine has averaged around 10,000 tons per year. Geo Resources typically hires a contractor to remove the earth covering its leonardite and then employs a front-end loader to mine and load the mineral into trucks. The trucks deliver the leonardite to the processing plant located about a mile away.(4)

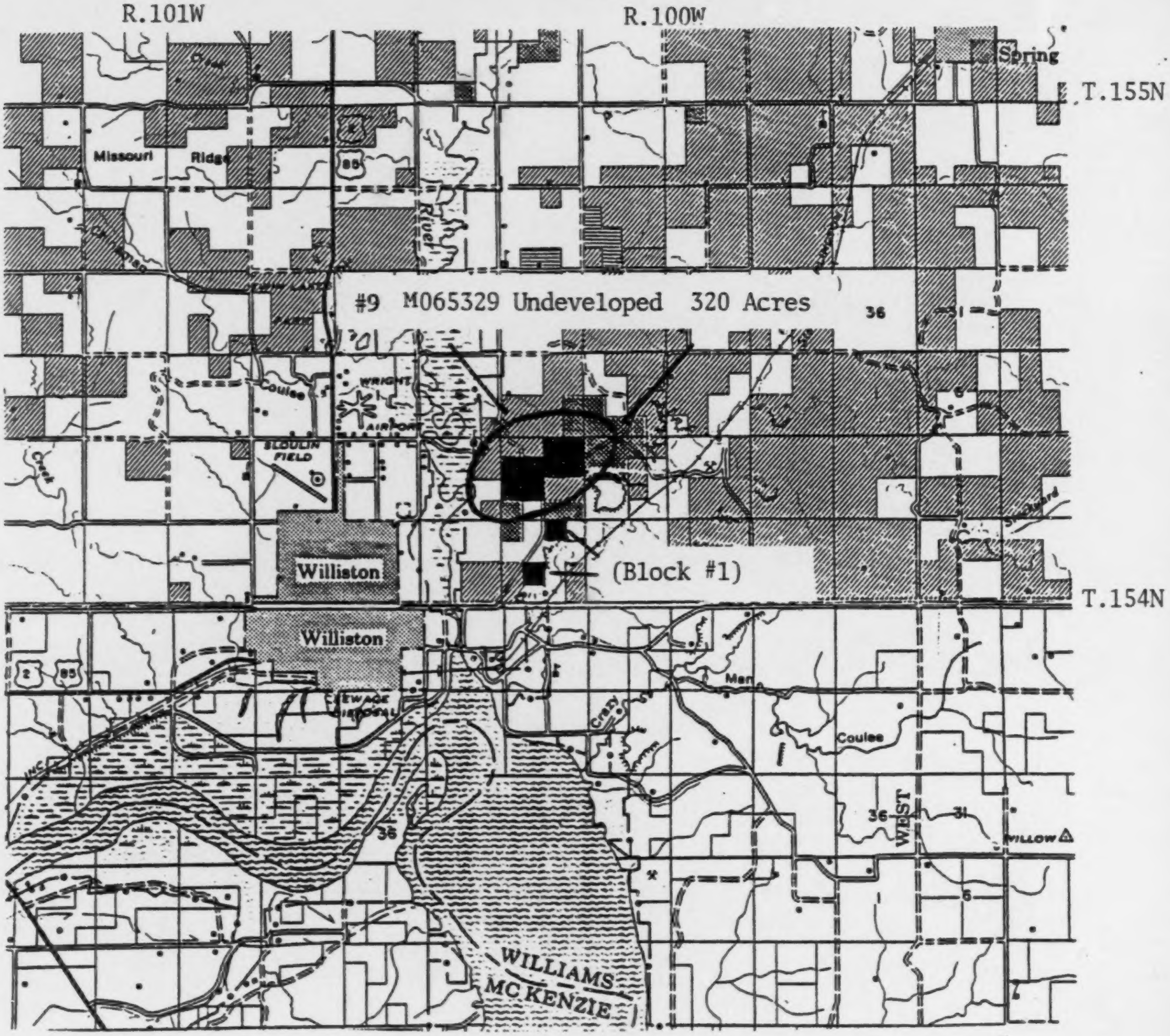
Even this small mining and manufacturing operation has had to contend with regulations associated with environmental legislation passed in the 1960s and 1970s. First, its processing plant was required to attach a scrubber in order to meet air emissionstandards established by the North Dakota Department of Health. Although Geo Resources does not expect to be required to add additional pollution abatement equipment at its processing facility, they have recently been informed that control measures at the mine site are not up to the standards required by state water quality regulations. While a small operation such as the one maintained by Geo Resources can have difficulty in paying for environmental control technologies, the company appears able to withstand the burden.(5)

Geo Resources
Page Two

Geo Resources' existing mining operation is immediately adjacent to its federal coal lease. Logical progression of their current mining activity will lead to mining the federal lease in five to ten years. The company is currently in the process of preparing a mine plan application to be filed with both the state Public Service Commission and the Office of Surface Mining. The plan will include all of the federally leased acreage as well as 80 acres of land in between the mine and the lease area. According to Geo Resources, the mining permit application is being designed specifically to allow the company to meet the due diligence requirements as specified by DOI.

Geo Resources is hoping that it will not have to include lignite reserves located below the leonardite bed in its current mine plan. The company feels that current markets for lignite in the Williston area are virtually nonexistent and recovery of these coals would be economically unsound. It is not clear if USGS would approve a plan that does not include mining of these deeper lignite deposits. But, given a ready market for leonardite at its own processing plant and the commitments that Geo Resources has already made towards development of a mine plan, it is likely that diligence requirements will be met for this lease tract.

1. U.S. Department of the Interior. Automated Coal Lease Data System printout dated September 1980.
2. 1980 Keyston Coal Industry Manual. McGraw-Hill, 1980.
3. Merril Gray, Geo Resources, Inc. Telephone interview comments. October 1980.
4. Ibid.
5. Ibid.
6. Ibid.
7. Ibid.


R.101W
R.100W
Spring
T.155N
Missouri
Ridge
River
#9 M065329 Undeveloped 320 Acres
36
Coulee
WRIGHT
AIRPORT
SLOULIN
FIELD
Williston
(Block #1)
T.154N
Williston
Coulee
Man
Crazy
36
31
WEST
WILLOW
6
WILLIAMS
MC KENZIE

SCALE: 1/2 inch = 1 mile

MAP __

WILLIAMS COUNTY

BLOCK # 9 Georesources Exploration, Inc/Nelson Pit

UNDEVELOPED LEASE BLOCK SUMMARY SHEET

Lease Block Name: New Leipzig Block No. 11

Owner/ Parent Co. Knife River Coal Mining Co./ Montana Dakota Utilities

County: Grant & Hettinger Location: T134N, R91W / T134N, R90W
State: North Dakota

LEASE DATA

Lease Number	Acres	Reserves	Btu/lb.	Sulfur		Ash	Seam thick.	Overburden thick.	ratio
		M Tons		%	#M Btu	(%)	(ft.)	(ft.-ave.)	
M-437	640	Total =	7050	0.9	1.27	8			
	2872	Mineable= Re-coverable =	7050	0.9	1.27	8			
Total/ Average									

APPLICATION OF SCREENS

Primary Screens								Secondary Screens (+ favorable - unfavorable)					
LMU	Res.*	Btu	S	Ash	Seam Thick.	Overburden Thick.	Ratio	Own.	Act.	Tran.	Geo.	Env.	Leg.
+	+	+	+	+	+	+	+	+	+	-	+	?	+

Development Prospects: Favorable If favorable, suitable for yes steam (export)
yes steam (on-site) no synthetic fuels (on-site)

Production Prospects 1986: Unfavorable 1991: Uncertain

COMMENTS:

Both these leases are associated with Knife River Coal Mining Company's private fee coal holdings in the New Leipzig Known Recoverable Coal Resource Area. The 2 leases, designated M437 and M438, cover 2,498 acres of privately held surface lands and include a reserve base of over tons of lignite. Like most of the existing North Dakota federal leases both consiste of noncontiguous tracts of coal reserves interspersed with privately owned coals. As is typically the case in this stte, the coal company holding the federal lease has already signed agreements to mine with private parties who control interest of the surface and mineral rights for lands adjacent to the government owned coal. Combined federal and private lignites leased by Knife River amount to around 85 million tons of reserves, more than enough to fuel a 400 MW power plant for the next 30 years.* Overburden ranges from 40 to 100 feet and averages 50 to 60 feet throughout Knife River's holdings in the area. While this area lacks the abundance of glacial till found further north, socid spoils have not caused any problems at a small mine located near the leases.(1,2)

The lessee, Knife River Coal Mining Company (KRCMC), is one of the four largest producers of northern plains lignites. KRCMC has two producing lignite mines in North Dakota (Gascoyne and S. Beulah) and one operating in Montana (Savage). In addition to these mines, Knife River controls most of the coal in the New Leipzig area. As originally planned, markets currently served by the South Beulah mine were to be supplied with reserves from the New Leipzig area. Lignite resources at the South Beulah mine would then have been dedicated to Montana Dakota Utilities (MDU) Coyote I mine-mouth power plant and, if ever built, the Coyote II station. Thus, Knife River had a ready market for lignite from the undeveloped lease area, including MDV's Heskett #1 and #2 units located in Mandan, North Dakota (1 mm tons/year), Otter Trail Power Company's Hoot Lake facility in Fergus Falls, Minnesota (0.7 mm tons/year), and a number of smaller industrial consumers.(3)

Problems arose during Knife River's negotiations with Burlington Northern Railroad, the company which controls the track that serves the New Leipzig area. Apparently the existing road bed is designed to carry light traffic only. In order to haul coal in the quantities projected, the track must be upgraded at a cost of somewhere between 20 and 24 million dollars, including construction of a one and one half mile spur track. Burlington Northern has told KRCMC that the volume of shipments, including those for current and possible new contracts, would not be of sufficient quantity to support this initial capital investment. The railroad is willing to allow Knife River to put up the capital for upgrading the line. KRCMC probably does not have the financial resources to support funding of this project. The company feels that even if it did have the capital, the subsequent cost of mining the coal and paying for track repairs would make the price of lignite from New Leipzig noncompetitive with other locally produced lignites. It would appear that Burlington would have little to gain from upgrading the track. On the one hand, Burlington already has the contract to deliver coal that would be produced at New Leipzig. That coal is now being shipped by Burlington from Knife River's South Beulah mine. Knife River has no alternative to shipping the coal via Burlington Northern at either site. Thus, Knife River has been forced to increase its production capacity at the South Beulah mine in order to meet the fuel requirements of both its railroad shipped and new mine-mouth customers.(4,5)

While it is apparent that Knife River wishes to proceed with the development of this project, rail shipment of lignite from the site is probably out of the question. Initial work on drafting a mine plan, preliminary wildlife studies and plotting of recoverable resources have come to a standstill. (The project has been put on hold.) In the meantime, the Sprecher mine, a small operation which supplies coal for domestic consumption, will continue to produce coal from Knife River's private holdings at the site. Production from this small two acre pit, operated by Vernon Sprecher, may be the only coal ever produced at the site. (Knife River holds the permit to mine this area and is ultimately responsible for its reclamation--only 5 acres have been permitted for mining by the state Public Service Commission.)(6,7)

Future development of New Leipzig appears to be dependent on the construction of a mine-mouth coal conversion facility at the site. This is certainly not out of the question. In fact, given recent developments to the north where new facilities are not being granted permits to construct due to degradation of the air quality at the Class I designated Theodore Roosevelt National Park, the New Leipzig area still has a good chance for development. Development prospects at this site are higher than those of leased and unleased properties to the north which are depending on permits to construct new coal conversion facilities. Knife River has hinted that there have been discussions concerning the siting of mine mouth facilities at New Leipzig. But, at this time, no contract has been signed. Discussions with the State Department of health indicate that it is unknown if a facility sited at the New Leipzig area would increase daily concentrations of SO_2 at Theodore Roosevelt Park. (8,9)

If it is found that a facility located in the area will not affect air quality at Theodore Roosevelt Park, chances for development of the property by 1991 would appear to be high. If it would, chances for development are minimal to non-existent. Although KRCMC was unclear about whether it would consider applying for an extension to the due diligence deadline, the company seems interested in the site. Until more information is available OTA must conclude that development of this property containing the two federal leases is highly uncertain.

1. U.S. Department of the Interior. Automated Coal Lease Data System printout dated September 1980.

2. Alan Mace, Knife River Coal Mining Company. Interview comments, September 1980.

3. Ibid.

4. Ibid.

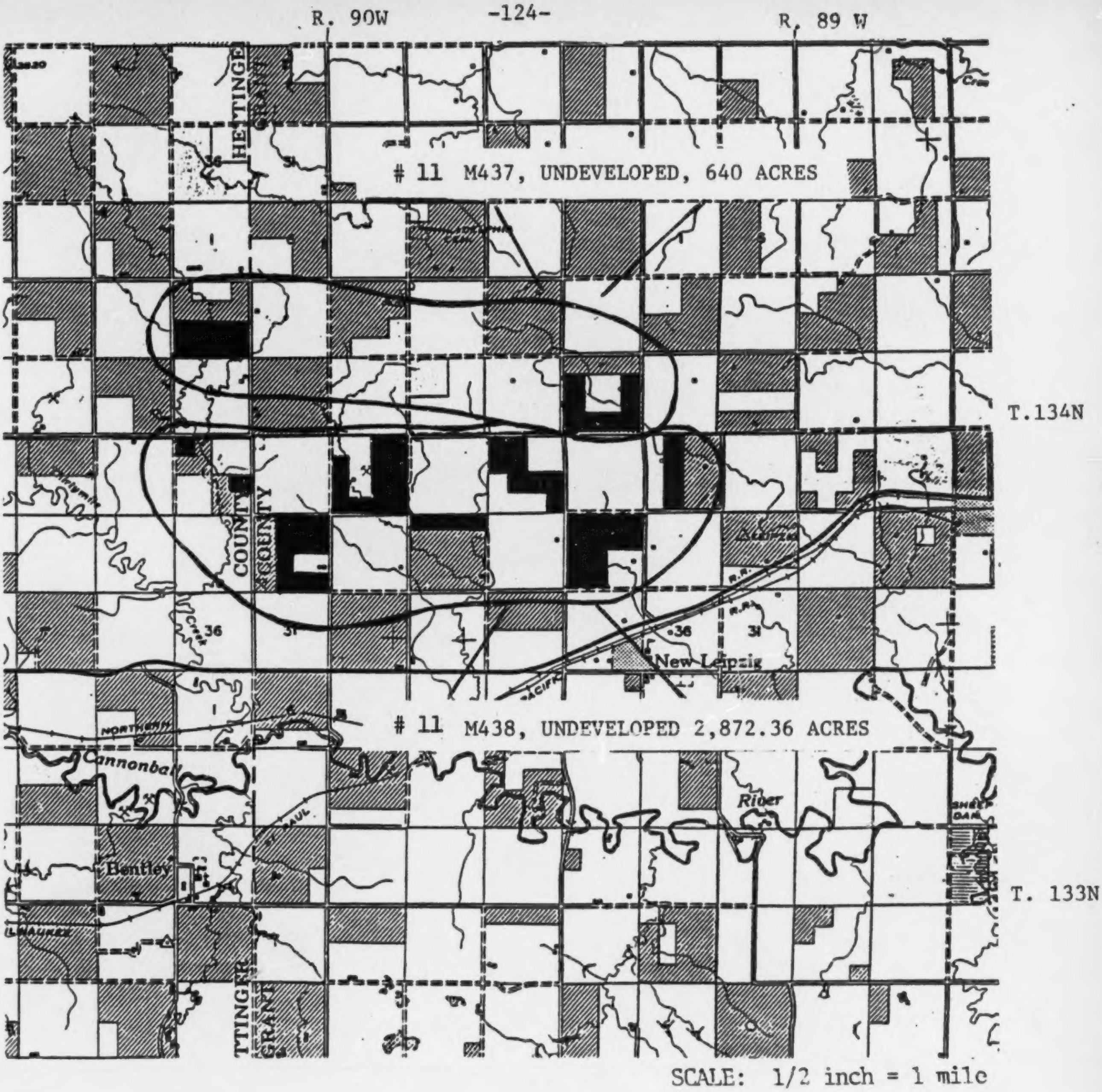
5. Ed Englerth, North Dakota Public Service Commission. Interview comments, September 1980.

6. Alan Mace, op. cit.

7. Jerry Reichert, Knife River Coal Mining Company. Telephone interview comments, August 1980.

8. Alan Mace, op. cit.

9. Gene Christiansen, North Dakota Department of Health. Interview comments, September 1980.


R. 90W
R. 89 W
# 11 M437, UNDEVELOPED, 640 ACRES
# 11 M438, UNDEVELOPED 2,872.36 ACRES
T.134N
T. 133N
HETTINGER
GRANT
COUNTY
COUNTY
New Leipzig
Bentley
Cannonball
River
NORTHERN
PACIFIC
ST. PAUL
36
31
SCALE: 1/2 inch = 1 mile

MAP

HETTINGER & GRANT COUNTIES

BLOCK #11 KNIFE RIVER COAL MINING CO./NEW LEIPZIG

UNDEVELOPED LEASE BLOCK SUMMARY SHEET

Lease Block Name: Leroy Bonsness Block No. 13

Owner/ Parent Co. Leroy Bonsness

County: Burke Location: T16N, R93W

State: North Dakota

LEASE DATA

Lease Number	Acres*	Reserves M Tons	Btu/lb.	Sulfur %	Sulfur #M Btu	Ash (%)	Seam thick. (ft.)	Overburden thick. (ft.-ave.)	ratio
BLM018322	80	In place= Recoverable=				7.6			
Total/ Average									

APPLICATION OF SCREENS

Primary Screens								Secondary Screens (+ favorable - unfavorable)					
LMU	Res.	Btu	S	Ash	Seam Thick.	Overburden Thick.	Overburden Ratio	Own.	Act.	Tran.	Geo.	Env.	Leg.
+	-	+	+	+	+	+	+	-	-	-	+	+	+

Development Prospects: Unfavorable If favorable, suitable for no steam (export) no steam (on-site) no synthetic fuels (on-site)

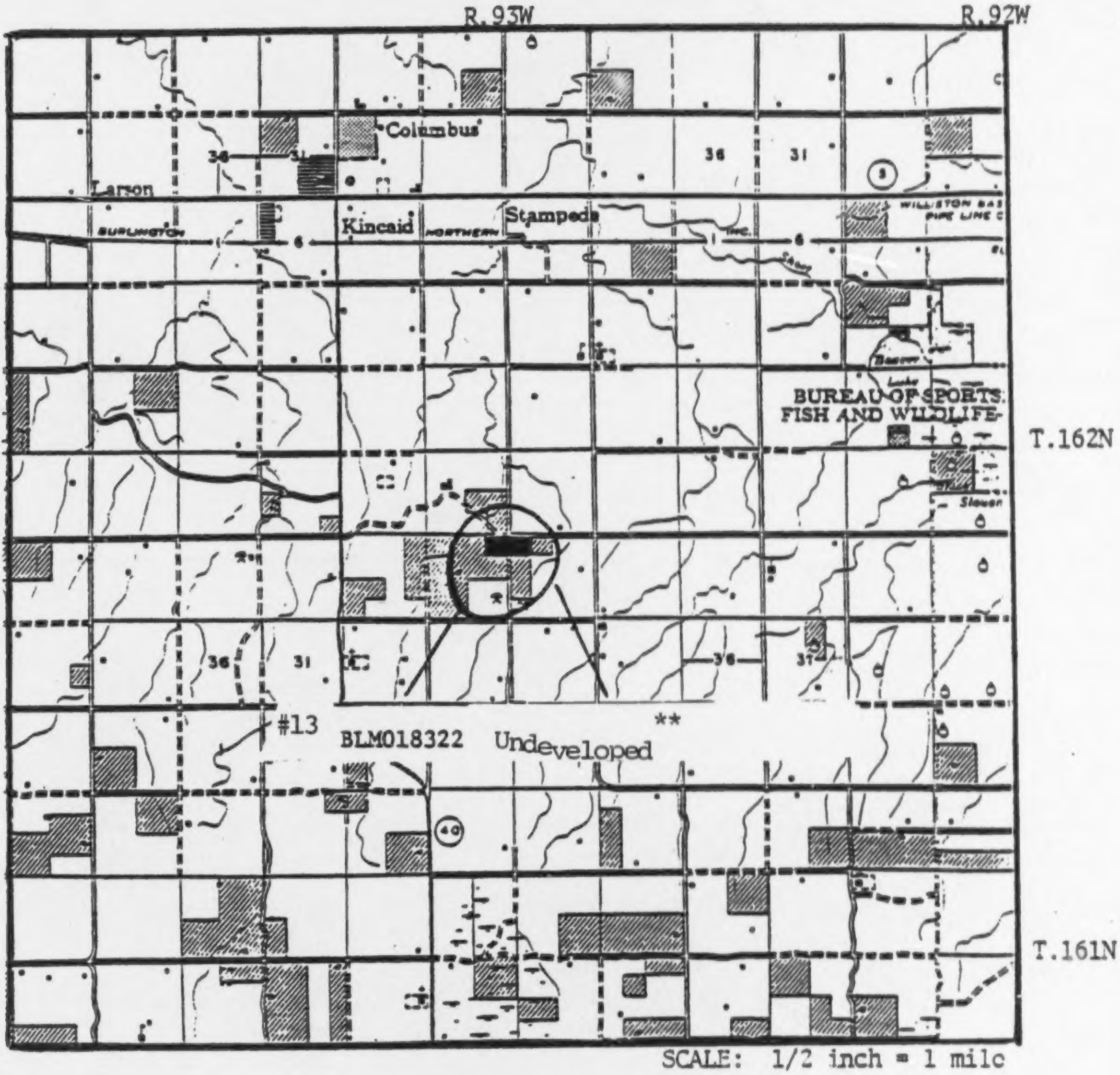
Production Prospects 1986: Unfavorable 1991: Unfavorable

COMMENTS:

In 1910, Leroy Bonsness began mining fee coal in an area located about five miles south of Larson, North Dakota. By 1951, his mining operations had progressed into a 40 acre tract of federally leased land in Section 27, which was mined until 1969. An additional 40 acres, located in Sections 21 and 28, were added to the Bonsness lease in 1968. Mining in this new area began in 1969, but only 3 acres were disturbed before the mine was closed in 1972. All of the available coal in Section 27 was mined between 1951 and 1970 and sold in local markets. Total production from the 80 acre lease amounted to 167,733 tons and, while reserve estimates are not known, it is possible that approximately the same tonnage remains in the unmined portion.(1)

In 1976, the Bureau of Land Management inspected the mine site and recommended that Section 27 be released from bond, since it had been satisfactorily reclaimed. Reclamation has been initiated on Sections 21 and 28, and when future inspections determine that the area is satisfactorily reclaimed, the entire lease will be formally relinquished.(2)

1. Douglas H. Hileman, U.S. Geological Survey Conservation Division, Billings, Montana. Memorandum to Stan Shepard, Minerals, Bureau of Land Management, Miles City, Montana. "Inspection of Coal Lease BLM(ND)018322." December 23, 1974.
2. George Meuberg, District Manager, U.S. Bureau of Land Management, Miles City, Montana. Memorandum to State Director, Montana. "Relinquishment of LeRoy Bonsness Coal Lease BLM(ND)018322.


R.93W
R.92W
Columbus
Larson
36
31
Kincaid
Stampede
BURLINGTON
NORTHERN
WILLISTON BASIN PIPE LINE CO
BUREAU OF SPORTS FISH AND WILDLIFE
T.162N
36
31
#13
BLM018322
Undeveloped
**
T.161N
SCALE: 1/2 inch = 1 milc

MAP VI-13

BURKE COUNTY

BLOCK #13 LEROY BONSNESS

** This lease was mined out before passage of the Surface Mine Control and Reclamation Act of 1977. However, it has been classified by OTA as undeveloped since no mine plan was submitted to the Office of Surface Mining.

UNDEVELOPED LEASE BLOCK SUMMARY SHEET

Lease Block Name: U.S. STEEL Block No. 15

Owner/ Parent Co. U.S. Steel Corporation

County: Dawson Location: T19 & 20N.
State: Montana R55 & 56E

LEASE DATA

Lease Number	Acres	Reserves	Btu/lb.	Sulfur		Ash	Seam thick.	Overburden thick.	ratio
		M Tons		%	#M Btu	(%)	(ft.)	(ft.-ave.)	
M3831 M3832	2559.04 2537.14	Mineable = Recoverable=	6736	0.32	0.47	5.7			
Total/ Average									

APPLICATION OF SCREENS

Primary Screens -								Secondary Screens (+ favorable - unfavorable)					
LMU	Res.	Btu	S	Ash	Seam Thick.	Overburden Thick.	Overburden Ratio	Own.	Act.	Tran.	Geo.	Env.	Leg.
-	+	+	+	+	+	+	+	+	-	+	+	+	-

Development Prospects: Unfavorable If favorable, suitable for no steam (export)
no steam (on-site) no synthetic fuels (on-site)

Production Prospects 1986: Unfavorable 1991: Unfavorable

COMMENTS:

As defined by OTA criteria, Leases No. M3831 and No. M3832 are considered a single lease block. Factors affecting their development prospects are the same. Both leases are in close proximity to one another, both are held by U.S. Steel and the two leases would likely be developed in conjunction with the same mine. Combined, the two Montana leases cover 5096 acres near the Montana-North Dakota border.(1)

Originally acquired in 1967, the leases were to provide fuel to pelletizing plants associated with U.S. Steel's iron ore holdings in Minnesota. Prospects for this kind of development are now unfavorable due to depressed market conditions for steel produced in the U.S. Without this captive market, U.S. Steel must find an alternative use for lignite produced from the leases. Field studies conducted by the USGS suggest that the leases have a relatively high development potential due to the large quantity of recoverable reserves concentrated in one thick, almost horizontal bed. But, like other Fort Union leases, the presence of a market for lignite often is the overriding issue associated with the development of a lease. (2,3)

U.S. Steel has been unsuccessful in negotiating contracts for lignite produced at the site. Given the bleak prospects for identifying an export market, the company would like to attract a mine-mouth synfuels or electric power plant to the site. In any case, U.S. Steel foresees difficulty in meeting BLM's diligence requirements for coal production from its leases. (4)

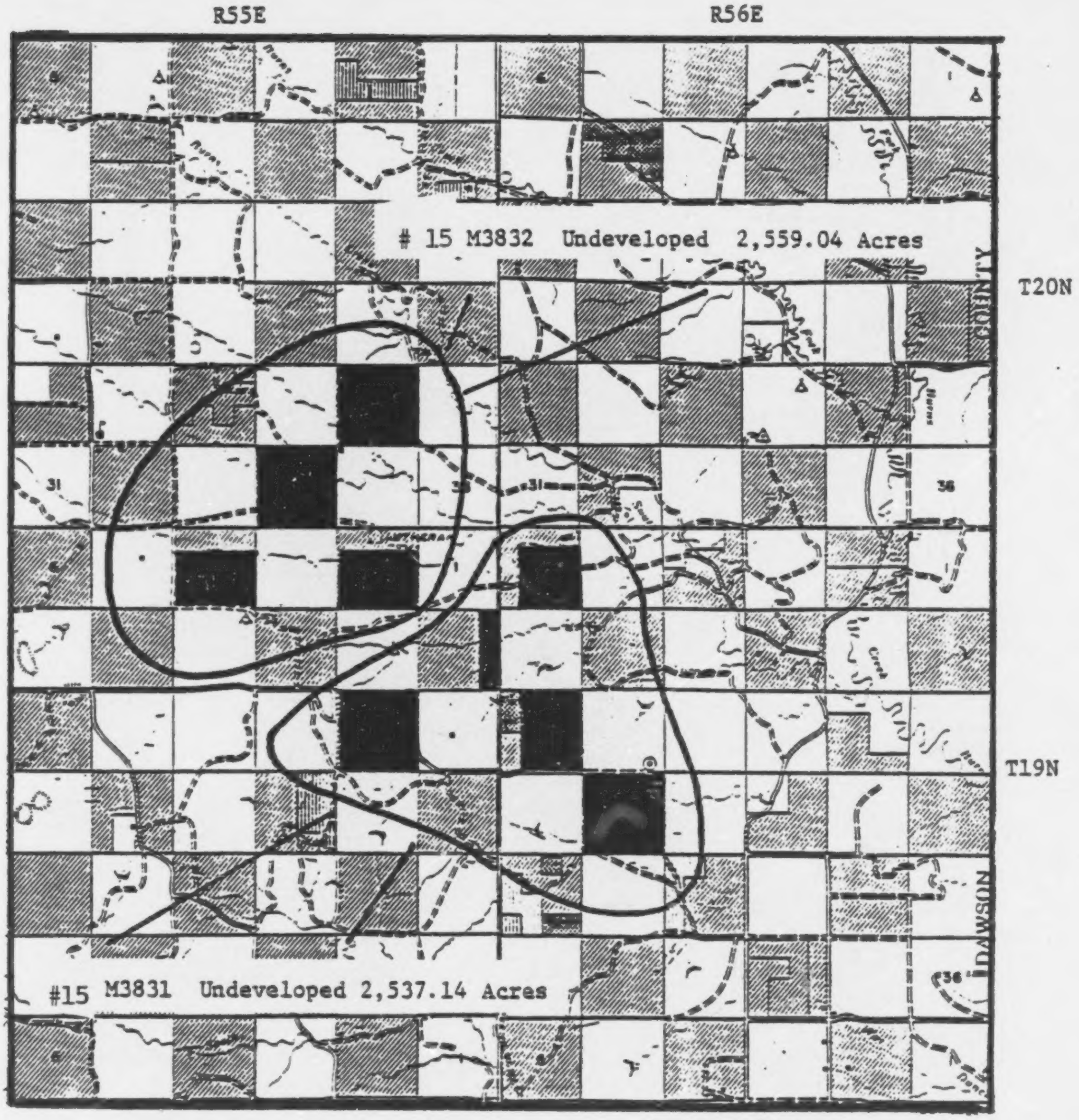
If U.S. Steel applies to BLM for an extension for meeting diligent development requirements, the request will probably be based on the untried synfuels technology, and the capital requirements for synfuels plant construction. However, based on discussions with the Montana Department of Natural Resources (DNR), which has the authority to allocate water rights for the Yellowstone River Basin, U.S. Steel's option for a synfuels plant is probably not viable. Synfuels plants typically require in excess of 500 cubic feet of water per second—a large quantity of water in relation to the water rights already reserved from the Yellowstone River. Application for water permits is a lengthy and complex task which U.S. Steel has not initiated. Moreover, Montana's DNR water policy is not favorably predisposed to issuing water rights to large industrial consumers.(5,6,7)

This leaves U.S. Steel with the option of constructing a conventional mine-mouth electric generating facility. This alternative is less likely to be precluded by water availability and does not appear to be constrained by the availability of air quality increments. However, the process for applying to the state DNR for a permit to construct is lengthy and, to date, there is no evidence that U.S. Steel has begun this process either.(8)

Mineral ownership patterns may also inhibit production from this lease. The sections leased by U.S. Steel are "checkerboarded" with railroad holdings, state and fee lands, and leases held by Mobil Oil. According to U.S. Steel, there are a few sections that could conceivably be developed in cooperation with Mobil Oil. However, U.S. Steel apparently has not held any discussions with Mobil nor taken any action toward defining a logical mining unit.(9)

Based on U.S. Steel's lack of activity concerning development of these leases, it seems that the most credible argument for extending diligent development requirements will rest on the assertion that a soft market for coal is projected in the short term. Further, they may argue that the excess coal capacity projected for the region by 1986 is due, in part, to companies trying to comply with legislated production requirements. Irrespective of any arguments, U.S. Steel might make, the development of these two leases by 1991 is unlikely.

1. U.S. Department of the Interior. Automated Coal Leasing Data System printout dated September 1980.
2. J.K. Hayes, Manager, Western Lands and Minerals, U.S. Steel Corporation, Provo, Utah. Telephone interview comments October 1980.
3. U.S. Geological Survey. General Mining Order No. 1--U.S. Steel, Billings, Montana.
4. J.K. Hayes, op. cit.
5. Ibid.
6. Don Riddle, Montana Department of National Resources Water Rights Bureau, Billings, Montana. Telephone interview comments, October 1980.
7. Jack Schmidt, Helena, Montana. Telephone interview comments, October 1980.
8. Lou Hammermeister, Montana Department of Natural Resources, Air Branch, Billings, Montana.
9. J.K. Hayes, op. cit.


R55E
R56E
T20N
T19N
# 15 M3832 Undeveloped 2,559.04 Acres
#15 M3831 Undeveloped 2,537.14 Acres
COUNTY
DAWSON
31
36
31
36

Scale: 1/2 inch = 1 mile

MAP V-7

DAWSON COUNTY, MONTANA

#15 U.S. Steel Corporation

CHAPTER VI - ASSESSMENT OF DEVELOPED FEDERAL COAL LEASES

A. Overview of Developed Lease Analysis

This chapter summarizes the current status of the developed federal coal leases in North Dakota. In this report, developed leases are defined as those leases included in a pending or an approved mining plan or those leases which have had coal extracted from them in the past. This study also summarizes the current status of mine plan proposals under review by state and federal authorities. The information contained in this chapter will serve as part of the data base for the Office of Technology Assessment's comprehensive study of federal coal leases.

Principal data sources for the developed lease summaries are mining and reclamation plan submittals on file at the U.S. Office of Surface Mining Region V offices, Denver, Colorado and General Mining Order No. 1 data on file at the U.S. Geological Survey Conservation Division office in Billings, Montana. These data were supplemented by interviews with staff members of the agencies above and staff of the U.S. Bureau of Land Management (Billings, Montana), the North Dakota Public Service Commission, North Dakota Department of Health, North Dakota Geological Survey and lignite mining operations located in North Dakota.

Figure VI-1 provides a map of the location of the mines discussed in the following mine summaries.

B. Summary of Developed Lease Assessments

Each mining operation holding a federal coal lease in North Dakota is individually discussed in the attached mine summaries. The cover sheets provide an overview of the mine operation while the following discussions provide information on issues which may affect the production of lignite reserves leased from the federal government. Maps detailing the specific location of the federal leases and the probable direction of mine advance are included for most of the mines.

	LEASE BLOCK: 2
MINE NAME: Center Mine	LEASE NO: M043848(ND)
LOCATION: 3 miles southeast of Center, North Dakota	LESSEE: Baukol-Noonan, Inc.
SPECIFIC LOCATION: T142N, R83W & R84W	
FIRST COAL SHIPPED: 1970	MINE LIFE: 40 years
1979 PRODUCTION: 3.76 million tons	MINING METHOD: Strip

PROJECTED PEAK PRODUCTION: 4.3 million tons/year

TOTAL PERMITTED ACREAGE: 2892 acres

TOTAL DISTURBED ACREAGE:

PENDING ACTIONS: Mine permit application filed April 1980 (213 acres including 160 acres federal coal) pending approval from U.S. OSM and North Dakota Public Service Commission.

COAL DATA

RANK: Lignite	FEDERAL RESERVES: IN PLACE:
NAME: (1) Kinneman Creek (2) Hagel	RECOVERABLE:
AVERAGE THICKNESS:	AVERAGE OVERBURDEN:
SEAM DIP: 90 feet per mile (1.5°)	OVERBURDEN RATIO:*
BTU/LB: 6597	
% SULFUR: 0.7	*Based on averages of seam thickness and overburden depths

NOTES:

- Production will range from 3.8 to 4.2 million tons per year in order to supply lignite to Minnkota Power Cooperative's Milton R. Young (234 MW) and Square Butte (454 MW) mine-mouth power plants.

- Baukol-Noonan has not mined any Federal coal since 1972.

- With the exception of recently discovered problems concerning disposal of fly ash wastes in the mine pit, the Center Mine has not been hampered by any environmental or technical constraints to mining at its current level of production.

CENTER MINE

The Center Mine, owned and operated by Baukol-Noonan, Inc., is located in Oliver County, North Dakota. The mine is about 3 miles southeast of the town of Center and about 35 miles northwest of Bismarck. Opened in 1970, the mine initially extracted 1.6 million tons of coal annually. Between 1976 and 1980, the mine was expanded to its current 4.3 million tons per year capacity. At the end of 1978, when annual production was about 3.4 million tons, the Center mine was ranked the 12th largest coal producer in the nation. Despite increased production (3.76 million tons), Center mine's production ranking fell to 19th nationwide at the end of 1979.(1,2,3)

Originally, the Center mine was designed to provide fuel for Minnkota Power Cooperative's Milton R. Young 234 MW power plant. This plant is located at the mine site and requires about 1.6 million tons of coal per year. When the Square Butte 454 MW power plant was added to the site in 1977, the demand for lignite produced at Center more than doubled. In total, lignite production at the mine will have to range from 3.8 million to 4.2 million tons per year to power the two generating plants. Personnel familiar with the Center operation have suggested that Baukol-Noonan holds enough reserves in the area to mine coal from the site for the next forty years.(4,5)

The mine site is located in the glaciated portion of the Missouri Plateau section of the Great Plains Physiographic Province. The topography is generally rolling and dotted with a few small, steeply sloping areas. Currently, Baukol-Noonan, Inc. is mining two lignite seams in the Sentinel Butte Formation. The main seam, known as the Hagel bed, is the lowermost major lignite seam in the Sentinel Butte Formation. This is separated from the overlying Kinneman Creek bed by 5 to 50 feet of sediment. Regionally, the Hagel bed has an average thickness of ten feet and often splits into two or more minor seams separated by several feet of sediment. In the proposed mining area the Hagel bed is split into two seams. The total thickness of this lignite varies from to feet including the clay parting. The upper seam is known as the Kinneman Creek bed. This seam is associated with less persistent overlying and underlying seams of lignite and carbonaceous clay. The main seam of the Kinneman Creek bed is one of the most persistent and consistent lignites in the Knife River Basin. This main part of the Kinneman Creek Bed varies from two to eight feet in thickness in the mining area.(6,7)

Current mining equipment and technology places a practical limitation on the depth of overburden that can be removed by dragline to expose the underlying coal seams. At the Center mine this depth limitation is approximately one hundred twenty (120) feet. For coal seams located beyond this depth, additional procedures are employed to recover the coal. The Center mine plan area includes several areas where the overburden depths exceed this practical limitation of 120 feet. In these areas, earth moving scrapers may be used to remove overburden from the hilltops in advance of the dragline stripping operations. This spoil material would be hauled by the scrapers and placed in the spoil pile valleys of previously mined strips. Another means of removing such overburden in these areas is to use the dragline to strip the overburden to workable depths before removing it from the path of coal extraction operations. Use of these procedures allows for recovery of as much of the coal resource as is economically practical.(8,9)

Baukol-Noonan, Inc. holds three distinct permits issued by the North Dakota Public

CENTER MINE (continued)

Service Commission. The permits allow coal to be mined from 2,891 acres at the Center site. All coal currently produced at the mine is from private fee lands. Baukol-Noonan, Inc. has held a lease to mine federal coal since January, 1962. (M-043848(ND).) The lease includes seven relatively non-contiguous tracts of reserves and encompasses 2,325 acres. Much of the lease area lies in the direct path of the current mining operations (Map VI-2). Baukol-Noonan, Inc. has not produced any federal coal since March of 1972. In April, 1980, Baukol-Noonan filed its first application to mine federal coal since the establishment of The Office of Surface Mining's permit program. The permit application includes 160 acres of federal coal and 53 acres of private coal.(10,11,12,13)

Since it began operations in 1970, the Center mine has produced a little less than half a million tons of federal coal. Baukol-Noonan estimates that   million tons of federal lignite will be mined from the area included in the newly filed mine plan--more than enough to meet federal diligence requirements for the lease. The company is currently in the process of developing an additional mine permit application that will include federal coal located in three additional sections. USGS staff have estimated that   million tons of federal coal will be extracted from the mine by the end of 1987. This assumes that Baukol-Noonan's mine plans are approved in a timely manner.(14,15)

An internal USGS memorandum suggested that if an orderly mining plan were followed, Baukol-Noonan would have started mining U.S. lignite in 1976. It was also stated that Center mine management was seriously considering by-passing the Government's coal in order to avoid the problems and studies required to get a mine plan approved. As can be seen from a map of the mine layout, (Map VI-2), Baukol-Noonan has mined as much coal as possible without proceeding into the federally held coal areas. According to one company estimate, the mine might run out of minable reserves if the mine plan is not approved by 1982. While Center mine has no plans to by-pass coal at this time, a major delay in permitting would leave the company few options beyond by-passing the federal lignite. Baukol-Noonan has previously left federal coal in the ground (for example, at its Larson mine) when it was unable to obtain an emergency by-pass lease in a timely manner.(17,18)

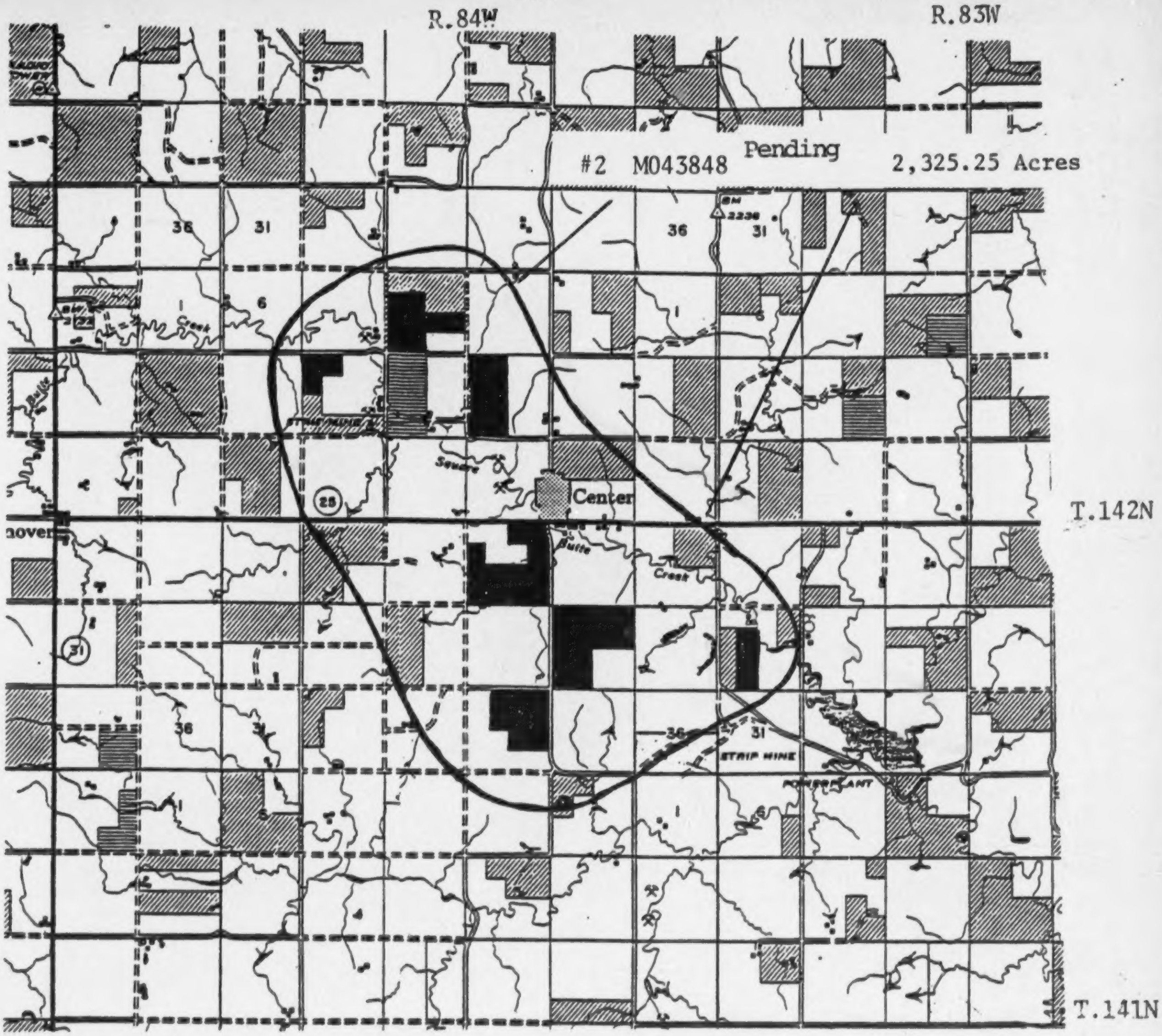
Until the results of a recent study conducted by Dr. G. H. Groenewold of the North Dakota Geological Survey (NDGS) were released, the Center mine was considered one of the more environmentally sound mining operations in the state. The occurrence of glacial till, gently rolling landscape, and the relatively small quantities of ground water entering the mine provide exceptionally good conditions for mining and reclamation activities. In the late 1970's, Minnkota's two power plants initiated an experimental ash and FGD waste disposal program using the open mine pits instead of surface settling ponds as a final disposal site. The NDGS drilled some wells around the mining operation to examine the effect of the activity on ground water quality. Although it was found that the FGD wastes contain sulfur and sodium which may enter the ground water, the concentrations eminating from these wastes were similar to those generated from the naturally occuring overburden. However, the disposal of fly ash along the pit bottom of Center mine has resulted in damage to local ground water quality. After disposal of fly ash, ground water pH levels were found to be exceptionally high (pH 12), and high

CENTER MINE (continued)

concentrations of heavy metals were also measured. Arsenic was among one of the most prominent and worrisome mineral elements found.(19)

Groenewold has come to the conclusion that wastes generated from the burning of North Dakota lignite in power plants are hydrologically active and that these wastes should be properly disposed in order to avoid transmission of toxics such as arsenic into ground water supplies. Groenewold believes that if the ash at Center mine had been placed in the "V's" between the spoil piles, instead of buried at the bottom of the pit, the effects of its disposal would not have been as damaging. In summary, Groenewold states that disposal of hydrologically active wastes such as these should not occur without a detailed study of the hydrology of the mine site. By using hydrological data, Groenwold was able to locate six sites ranging in area from one half to one square mile where disposal of power plant wastes would be acceptable. While research and selective disposal of ash could be costly, these costs would probably not prohibit future mining since alternative disposal methods, such as the use of settling ponds, are available to Baukol-Noonan. In the case of the Center mine, it is not certain that ground water in the area has been permanently damaged. In any case, with the exception of mitigation costs that may be levied against Baukol-Noonan or Minnkota, it is unlikely that this problem will not significantly affect future mining in this area.(20)

In summary, there are few environmental problems with mining coal at the Center Mine: local topographic relief is minimal, the abundance of glacial till at the site eliminates the sodic spoils problems prevalent at a number of other mine sites located to the south and west, and few environmental/cultural resources require mitigation measures. The major constraints to future mining activities are associated with delays that may occur with the pending mining permit application. For example, if the time required to process this permit extends beyond this year, the Center mine will probably not be able to maintain its current level of production.(21)


R.84W
R.83W
#2 M043848 Pending 2,325.25 Acres
Center
Square
Butte
Creek
Strip Mine
Power Plant
25
31
T.142N
T.141N

SCALE: 1/2 inch = 1 mile

MAP __

OLIVER COUNTY

BLOCK #2 BAUKOL-NOONAN, INC./CENTER MINE*

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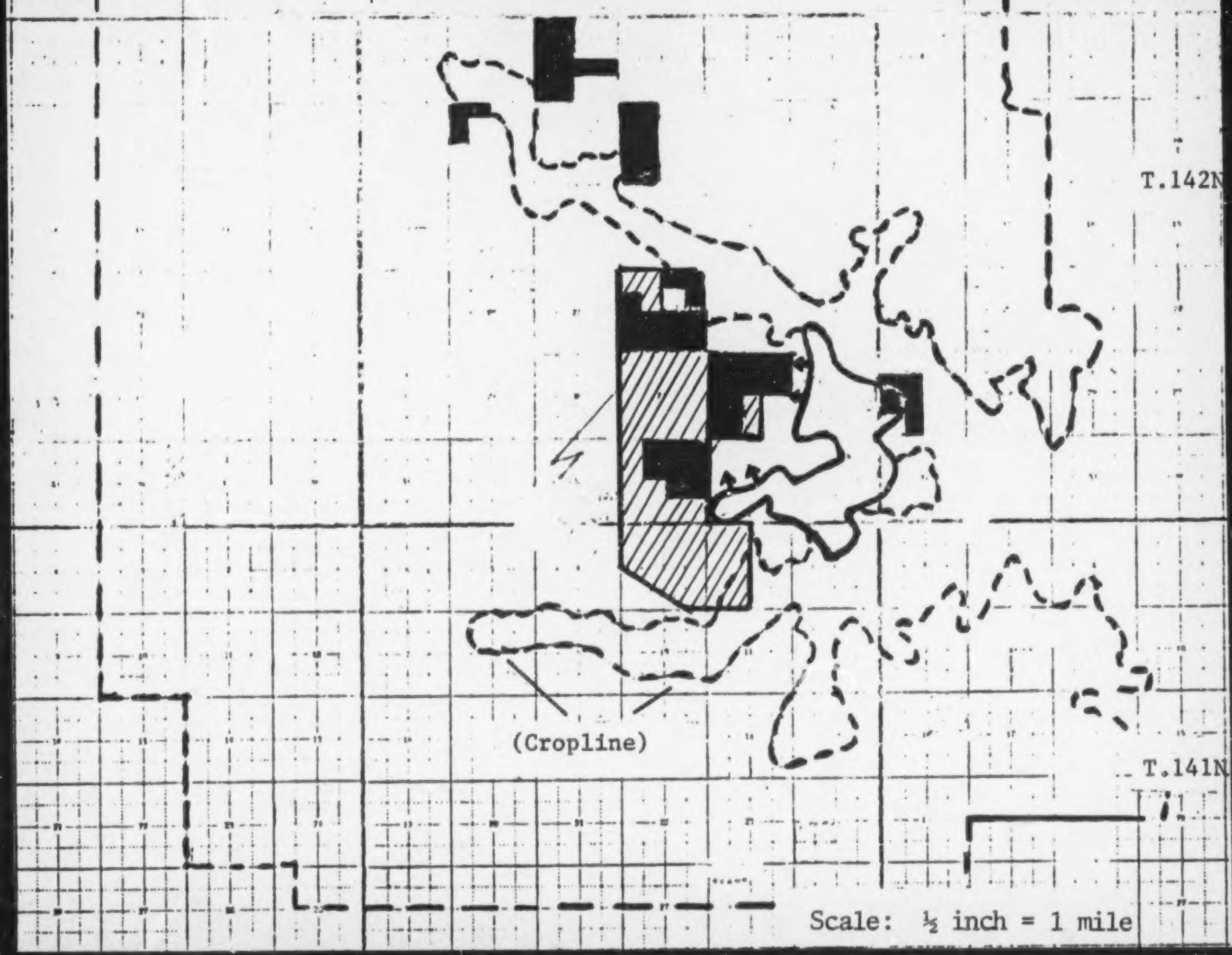
* See following map for detail of mining activity.

Map ____

Mining Activities, Block #2:
Baukol-Noonan/Center Mine


R85W
T.142N
T.141N
(Cropline)
Scale: ½ inch = 1 mile

Key

- ■ Federal Lease M043848
- ▨ Extended Mine Plan Boundary
- Mined Out
- → Direction of Advance
- Project Area

*Source: William B. Hansen;
USGS, Billings, Montana

1. U.S. Geological Survey, Billings, Montana (unpublished data).
2. 1979 Keystone Coal Industry Manual. McGraw-Hill, 1979.
3. 1980 Keyston Coal Industry Manual. McGraw-Hill, 1980.
4. U.S. Department of the Interior, Bureau of Land Management, Draft West-Central North Dakota Regional Impact Statement on Energy Development. January 1978.
5. Alan Hurlbut, Baukol-Noonan, Inc., Minst, North Dakota. Telephone interview comments. September 1980.
6. General Mining Order No. 1, Baukol-Noonan Center Mine, on file at U.S. Geological Survey, Billings, Montana.
7. Baukol-Noonan, Inc. Applications for a Mining Permit, Northeast Quarter and West 885′ of Southeast Quarter of Section 26, T. 142N, R. 84W. Presented to Department of the Interior, Office of Surface Mining, and North Dakota Public Service Commission. April 1980.
8. Ibid.
9. Alan Hurlbut, op. cit.
10. North Dakota Public Service Commission, Reclamation Division. Surface Mining and Reclamation Semi-Annual Report as of June 30, 1980.
11. U.S. Department of the Interior, Automated Coal Lease Data System, Printout dated September 1980.
12. General Mining Order No. 1, op. cit.
13. Baukol Noonan, Inc., op. cit.
14. U.S. Geological Survey, op. cit.
15. Alan Hurlbut, op. cit.
16. William B. Hansen, U.S. Geological Survey. Interview comments, September 1980.
17. Douglas H. Hileman, Conservation Manager, Central Region, U.S. Geological Survey. Memorandum to Chief Conservation Division--Examination-Coal Lease Montana 043848(ND), Baukol-Noonan, Inc. March 11, 1975.
18. Alan Hurlbut, op. cit.
19. Groenewold, Gerald H., et al., "Potential Effects on Groundwater of Fly Ash and FGD Waste Disposal in Lignite Surface Mine pits in North Dakota." Proceedings FGD Symposium, Houston, Texas. October 28-31, 1980.
20. Ibid.
21. Alan Hurlbut, op. cit.

LEASE BLOCK: 3

MINE NAME: Glenharold

LEASE NO: M21209(ND), M070203(ND), M11269(ND)

LOCATION: 3 miles south of
Stanton, North Dakota

LESSEE: Consolidation Coal Company; subsidiary of Continental Oil Company

SPECIFIC LOCATION: T134N, R84W;
T144N, R84W & R85W

FIRST COAL SHIPPED: 1965

MINE LIFE: 35 years

1979 PRODUCTION: 2.8 million tons

MINING METHOD: Strip

PROJECTED PEAK PRODUCTION: 3.8-4.0 million tons

TOTAL PERMITTED ACREAGE: 5,907.6 acres

TOTAL DISTURBED ACREAGE: 2,998 acres

PENDING ACTIONS: Revised mine permit application filed with North Dakota Public Service Commission and OSM in November, 1980

COAL DATA

RANK: Lignite

FEDERAL RESERVES:
IN PLACE:

NAME: (1) Kuether
(2) Hagel

RECOVERABLE:

AVERAGE THICKNESS:

AVERAGE OVERBURDEN:

SEAM DIP:

OVERBURDEN RATIO:*

BTU/LB: 6720/6622

% SULFUR: 0.54/0.68

*Based on averages of seam thickness and overburden depths

NOTES:

- Consolidation Coal has a long-term contract to supply 3.8 to 4.0 million tons per year of lignite to Basin Electric's Leland Olds mine-mouth power plant.
- Production dropped from 3.7 million tons in 1978 to 2.8 million tons in 1979. The shortfall was due to delays in obtaining a federal short-term lease and the unwillingness of the North Dakota Public Service Commission and OSM to approve Consolidation's Mining Permit Application to mine coal on the lease.
- The Glenharold Mine area contains many wooded draws, steep topography, and sodic spoil conditions. These factors make mining and reclamation difficult.

GLENHAROLD MINE

The Glenharold mine is owned and operated by the Truax-Traer Coal Division of Consolidation Coal Company, a wholly owned subsidiary of the Continental Oil Company. It is located in Mercer and Oliver Counties of North Dakota about two miles south of the town of Stanton (see Figure 1). The Glenharold Mine project area is composed of approximately 15,223 acres including support facilities. Consolidation Coal Company (Consol) currently holds three leases in the mine plan area, M21209(ND), M070203(ND), and M11269(ND), totalling 2,230 acres. (See Figure 2.) (1,2)

The Glenharold Mine area is on a dissected plateau between the terraces which border the broad, flat Missouri River flood plain to the northeast and a broad, gently rolling upland to the southwest. The mine area is dissected by ravines commonly referred to as breaks. The plateau ranges from about 300 to 430 feet above the Missouri River flood plain, and, locally, the relief is as much as 300 feet. The active mine area ranges in altitude from 1,780 to 2,080 feet. Headward erosion by the northeastward-trending ephemeral streams has produced a dendritic pattern of narrow, steep-walled treed valleys, commonly known as wooded draws.(3)

The Glenharold Mine is a multiple coal bed operation with up to four minable coal seams. The deepest recoverable bed, identified as the Stanton bed, ranges between and feet thick and is being mined to an average depth of feet. The overlaying coal seams range from two to six feet in thickness. These are being recovered where individual bed thickness is three feet or more and where seams divide if the separation between the split seams is less than two feet thick. Where the Hagel bed is overlain by more than 110 feet of overburden and is not being mined, the overlaying coal beds are also not being mined. A two foot seam about 10 feet below the Hagel bed is too deep and too thin to be recovered. Production was initiated on the other lease tract in 1979. The third lease (M21209(ND))was granted to Consol late in 1979 in response to a short-term lease application filed in December, 1978. If the pending mine plan filed with the North Dakota Public Service Commission (PSC) and the Office of Surface Mining (OSM) in April, 1980 had been approved, production of federal coal at the site would have increased dramatically. Instead, Consolidation's production dropped during 1979 and extraction of federal coals came to a standstill.(4,5)

Over the last 15 years, the Glenharold Mine has encountered a multitude of problems which have resulted in a rather poorly designed mine which contains nine distinct pits. The large number of pits is due to a number of factors including: the necessity to blend the mined coals in order to control sodium concentrations; an inability to obtain the rights to mine federal coal before the end of 1979; unfavorable topographical relief; and the existence of a large number of wooded ravines which, because of their scarcity, are considered a valuable state resource.(6)

Consol's difficulties in obtaining the federal coal leases at the Glenharold site began in 1972 when it applied for a lease of about 1,320 acres. Consol amended the lease application several times through 1975 requesting that several hundred acres be added to their initial request. By 1975, the Glenharold operation was rapidly converging upon unleased federal

GLENHAROLD MINE (continued)

holdings in 1975 and so Consol requested an immediate lease sale of 480 acres in January, 1976. The Bureau of Land Management subsequently prepared an Environmental Analysis Record (EAR) concerning the proposed lease area. The EAR, which was not finalized until the end of 1976, recommended that only 320 acres under the short-term criteria for leasing be offered for sale. The lease was finally offered for sale with the stipulation that the lands involved be reclaimed in accordance with the requirements of the proposed Surface Mine Control and Reclamation Act. Consol did not bid on the lease and instead mined what are called "short pits", that is pits that areless than a mile in length, as compared to an economically ideal length of 1 1/2 to 2 miles. In December of 1978, Consol again submitted a short-term coal lease application. During this same period, Consol's weekly deliveries of coal dropped from 76,000 tons per week to 55,000 tons. Although Basin Electric purchased 300,000 tons of coal from the neighboring United Power Association power plant, the Coop was forced to curtail power production and buy excess hydropower from the federal government. By the time the lease sale was conducted (at the end of 1979), Glenharold's coal production had dropped from 3.7 million tons (in 1978) to 2.8 million tons (in 1979).(7,8)

Although Consolidation did obtain the lease, they were not allowed to mine the federal coal until their mine plan, filed on April 30, 1980, was approved by both the Office of Surface Mining and the Public Service Commission. Included in Consolidation's application for a mining permit was a proposal to dump spoil into a number of wooded draws. The PSC has refused to let Consol disturb the woody draws until it shows that they can be reclaimed. Ed Englerth, Director of the PSC's Reclamation Division has stated that the PSC policy on woody draws is based on an incident that occurred a few years ago when Consol mined near to two large and heavily wooded draws. According to Englerth, the operation "made a general mess of things" and reclamation atempts were unsatisfactory. Steve Manger of OSM, in an internal memorandum argues that "many of the mine related activities involving wooded draws (at Glenharold) are largely a matter of convenience or efficiency, but not technical necessity or even desirability." According to Consol, nearly 60 million of the 125 million tons of coal remaining at Glenharold lie under woody draws. In terms of federal coal reserves that may not be recovered, Consol estimates that these could amount to as much as 29.4 million tons out of a total of 50.9 million tons. On the other hand, OSM believes that the amount of coal not likely to be recovered due to their stipulations against mining around the draws was much less than Consol's estimates. This is based on their belief that a high proportion of the draws are found in shallow to steep sided ravines and thus correlate with the coal cropline. Based on their review of the mine plan, OSM believes that Consol wished to either place spoil within steep sided draws (to avoid rehandle) or to mine across shallow sided draws in order to allow for a more efficient pit length; not to recover greater volumes of coal.(9,10)

In any case, the mine plan has not been approved as presented. In the short-term, it is likely that Basin Electric will continue to experience lignite shortages. During 1980, Consolidation is likely to only deliver 3.5 million of the 4 million tons Basin Electric requires for its operations in 1980. The PSC has allowed Consol to start premining work on 772.5 acres

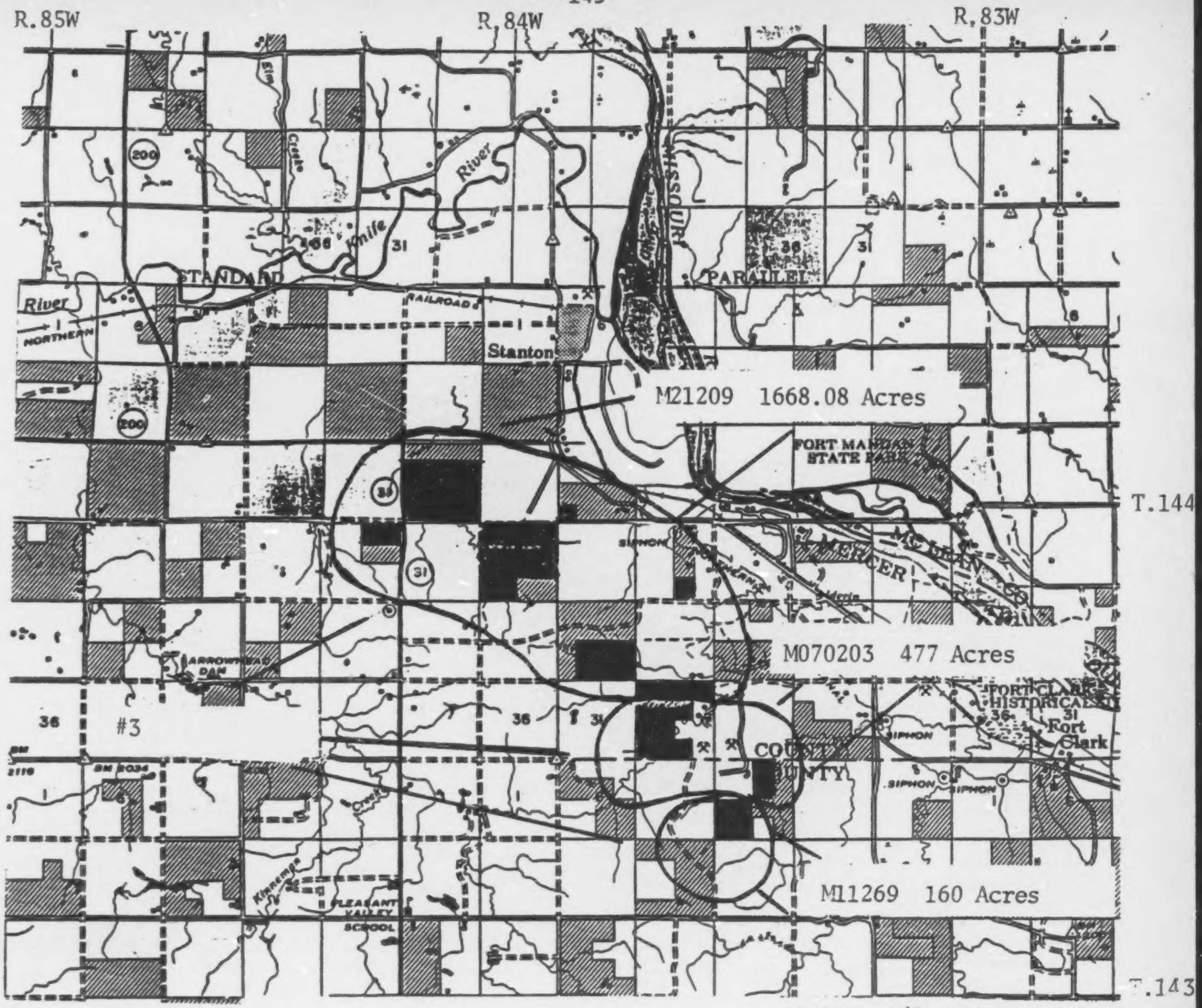
GLENHAROLD MINE (continued)

intended to be mined next year. During the next two years it is unlikely that a great quantity of federal coal will be extracted from the new lease area. In the long term, the draws will continue to cause a fuel supply problem for Basin unless the PSC either agrees Consol can restore them or decides that they need not be restored as draws. Basin has investigated other coal sources for Leland Olds. But, production from existing mines in the area is already committed to other plants and importing coal from Montana would require the building a railroad line to their plant.(11)

In the fall of 1965, the Glenharold Mine began supplying 1.3 million tons of coal per year under contract to a newly constructed 217 megawatt electric power plant, the Leland Old's No. 1 unit, operated by the Basin Electric Power Cooperative. Production was increased to 3.7 million tons annually in May 1975 to supply an additional 438 megawatt generating unit at the Leland Olds No. 2. Consol has a contract to supply coal to the Leland Olds facility for the next 35 years. Both the Basin Electric facilities are located about one mile from the Glenharold Mine and thus are considered mine-mouth generating plants. With the exception of a small amount of domestic sales, Consol sells all its annual Glenharold production to Basin Electric. (12,13)

While the federal government holds scattered mineral ownership of approximately 4,550 acres within the project area, it had only leased 560.77 acres to Consol before November of 1979. As of June, 1979, about 1.5 million tons of coal had been extracted from these federal areas. One of the two leases included in the 560 acres (M070203(ND)) has been virtually mined-out with the exception of 200,000 tons expected to be mined in 1983.(14)

Another unfortunate characteristic of the Glenharold property concerns the high concentrations of sodic substances found in the overburden. The problem is aggravated by the thin layered top soil in the area. Inadequate topsoil resources and high concentrations of sodic materials are likely to raise the cost of Consol's reclamation activities at Glenharold. Although reclamation at the mine site has been suggested to be quite successful in those areas of low relief, additional reclamation costs due to the occurrence of sodic deposits will do little to help this problematic operation.(15)


R.85W
R.84W
R.83W
Missouri
Knife
River
River
STANDARD
PARALLEL
RAILROAD
NORTHERN
Stanton
M21209 1668.08 Acres
FORT MANDAN STATE PARK
T.144
MERCER
McLEAN
SIPHON
M070203 477 Acres
ARROWHEAD DAM
#3
FORT CLARK HISTORICAL
Fort Clark
COUNTY
COUNTY
PLEASANT VALLEY SCHOOL
M11269 160 Acres
T.143

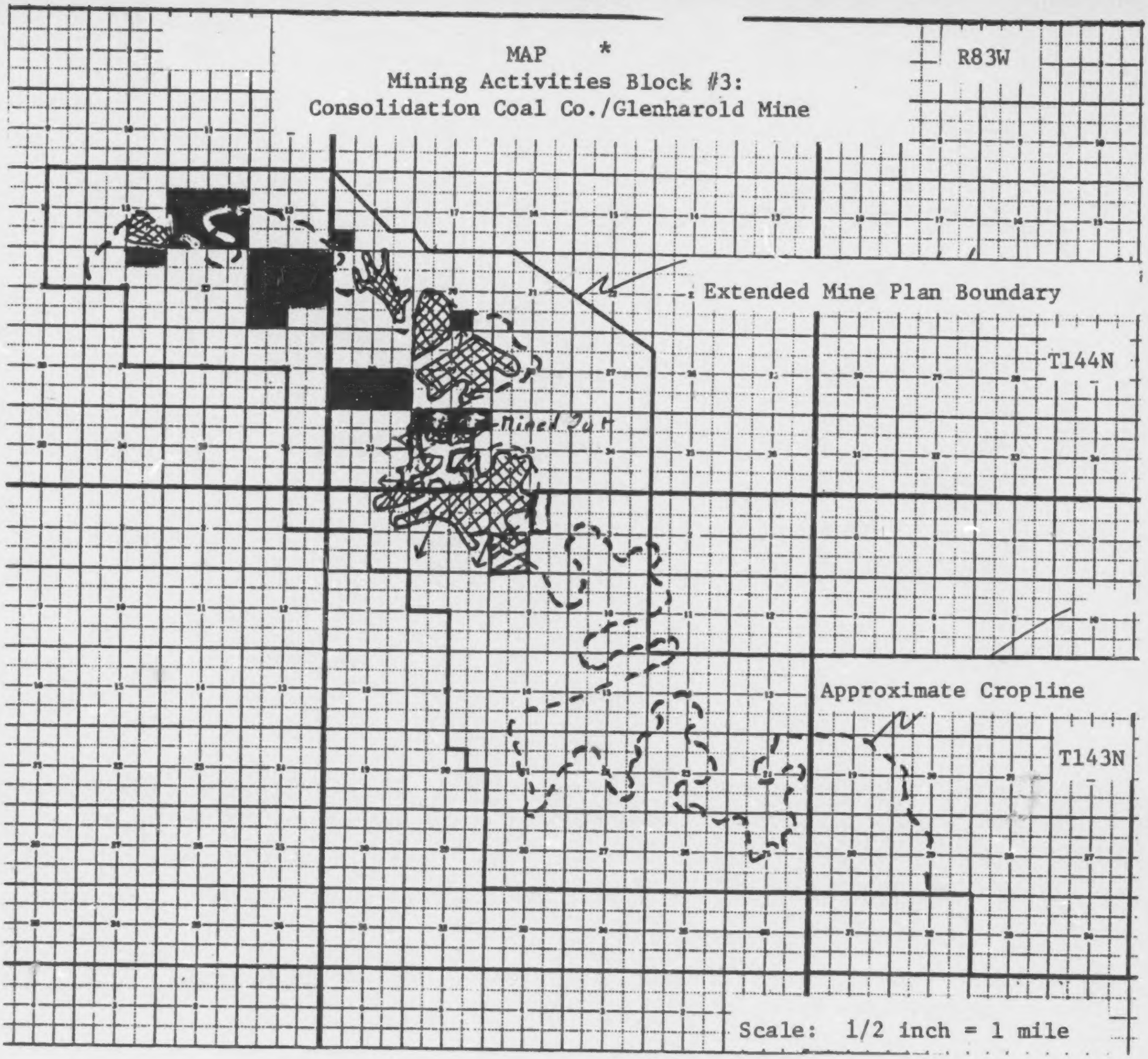
SCALE: 1/2 inch = 1 mile

MAP __

OLIVER & MERCER COUNTIES

BLOCK #3 CONSOLIDATION COAL CO./GLENHAROLD MINE*

* See following map for detail of mining activities.

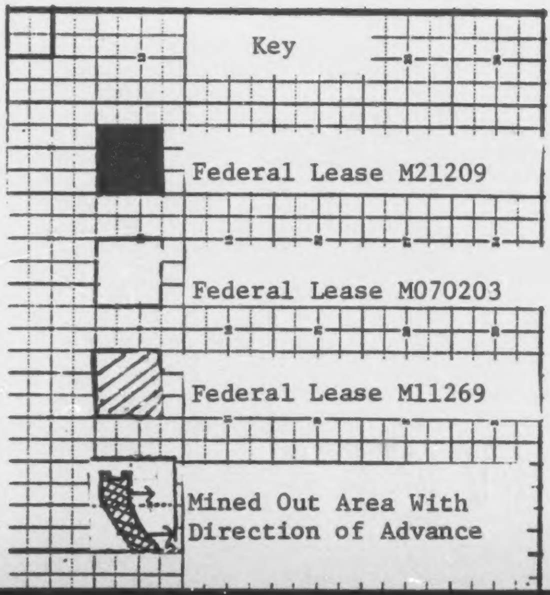

MAP *

Mining Activities Block #3:

Consolidation Coal Co./Glenharold Mine

R83W
Extended Mine Plan Boundary
T144N
Mined Out
Approximate Cropline
T143N
Scale: 1/2 inch = 1 mile

*Source: William B. Hansen
USGS, Billings, Montana


Key
Federal Lease M21209
Federal Lease M070203
Federal Lease M11269
Mined Out Area With Direction of Advance

1. U.S. Department of the Interior, Automated Coal Leasing Data System. Printout dated September 1980.
2. U.S. Department of the Interior, Bureau of Land Management, Technical Examination--Environmental Assessment: Glenharold Mine. Draft (no date).
3. Ibid.
4. Ibid.
5. William B. Hansen, U.S. Geological Survey, Billings Montana. Interview comments, September 1980.
6. Ed Englerth, North Dakota Public Service Commission. Interview comments, September 1980.
7. U.S. Department of the Interior, Bureau of Land Management, Land Use Analysis Consolidation Coal Company Coal Lease Application M212209(ND) Draft, May 1978.
8. "Basin Electric Makes Plans for Coal Shortfall at Plant--Glenharold Problems Cited," by Malcolm Ritter, Bismark Tribune (no date; article on file at U.S. OSM, Denver, Colorado.
9. Ibid.
10. Steve Mangar, U.S. Office of Surface Mining, Denver, Colorado. Memorandum to Donald Crane (OSM)--Consol's Glenharold Mine Plan Review, August 5, 1980.
11. Ed Englerth, North Dakota Public Service Commission. Interview comments, September 1980.
12. U.S. Department of the Interior, Bureau of Land Management, Land Use Analysis, op. cit.
13. Tom Bobi, Kelly Eliason and Norman Osterman, Consolidation Coal Company, Bismark, North Dakota. Interview comments, September 1980.
14. William B. Hansen, op. cit.
15. Ed Englerth, op. cit.

LEASE BLOCK: #6

MINE NAME: Beulah-Hazen Mine

LEASE NO: M071813
M042819

LOCATION: 4 miles north of
Beulah, North Dakota

LESSEE: Coteau Properties
Company; subsidiary of North
American Coal Company

SPECIFIC LOCATION: T144N, R88W; T145N, R87W
and 88W; T146N, R89W

FIRST COAL SHIPPED: 1983

MINE LIFE: 50 years

1979 PRODUCTION: 0

MINING METHOD: Strip

PROJECTED PEAK PRODUCTION: 12 million tons/year

TOTAL PERMITTED ACREAGE: 775.9 acres

TOTAL DISTURBED ACREAGE: 0

PENDING ACTIONS: Mine permit application filed January 31, 1980 (1,240 acres including 160 acres federal coal) pending approval from U.S. OSM and North Dakota Public Service Commission.

COAL DATA

RANK: Lignite

FEDERAL RESERVES:
IN PLACE:

NAME: Beulah Bed

RECOVERABLE:

AVERAGE THICKNESS:

AVERAGE OVERBURDEN:

SEAM DIP: Less than 1°

OVERBURDEN RATIO:*

BTU/LB: 6675

% SULFUR: 0.61

*Based on averages of seam thickness and overburden depths

NOTES:

- Pre-mining operations at Beulah-Hazen Mine were initiated in 1978.
- The mine is being designed to fuel a large complex of coal conversion facilities including the nation's first commercial scale coal gasification plant.
- Once the mine is at full capacity, it will be the largest lignite producing mine in North Dakota.
- Coteau holds two other federal leases which are likely to be included in future Beulah-Hazen Mine plans.

BEULAH-HAZEN MINE

Pre-mining operations at the Coteau Properties Company Beulah-Hazen mine were initiated in 1978. The mine, which is located several miles north of Beulah, North Dakota, is being designed to fuel a large complex of coal conversion facilities including the nation's first commercial scale coal gasification plant. The operator, Coteau Properties Company, is a subsidiary of North American Coal Company. Once this mine and North American's Falkirk mine have both been expanded to full capacity North American will be the number one producer of lignite in the state.(1)

Lignite initially extracted from the project area will be utilized to fuel Basin Electric Power Cooperative's Antelope Valley Station No. 1 and No. 2 units. Due to a slump in the growth of electricity demand, associated in part with the depressed national economic situation, opening of the two units has been delayed until the spring of 1983 and 1985 respectively. Once they are in operation, the two mine mouth units will require a total of 5.2 million tons of lignite per year. All of this coal will be derived from the Beulah-Hazen mine.(2,3)

The mine will also be the source of fuel for the Great Plains Gasification Associate's commercial-scale coal to high-Btu gas conversion plant. The first unit, costing $1.5 billion, will use Lurgi gasifiers to convert 22,000 tons of low-grade lignite daily into 125 million cubic feet of high-Btu gas--the equivalent of 20,000 barrels per day of oil. While no pilot plant has been built in the U.S., consortium spokesmen contend that risks are minimal since prototypes of the proposed plant already are operating in South Africa. The consortium consists of American Natural Resources (Detroit), Peoples National Gas Company (Chicago), Columbia Gas Systems, Inc. (Wilmington, Delaware), and Tenneco and Trans Continental Cos., Inc. (Houston).(4,5)

Until this past year it has been difficult for those involved to obtain the capital required to build the gasification facility. On July 9, 1980, the Department of Energy initiated the federal synfuels program, awarding $200 million to 110 project sponsors to design or study the feasibility of building plants to convert coal and other energy sources to oil or natural gas. The Great Plains group was awarded $22 million as an interim step before the project broke ground. Then, in late July, the administration provided the consortium with a federally backed loan guarantee of $250 million. With this financial backing, construction of the facility was to begin in August, 1980. But, following the Federal Energy Regulatory Commission's (FERC) approval of a financial plan for the project, suits were filed by General Motors and agencies representing the states who would eventually consume the synthetic gas. The intent of the suits was to block a special surcharge that FERC had recently allowed Great Plains. The surcharge would have been added to the bills of customers of the consortium companies, who serve almost one-third of the nation's natural gas customers. In addition, the consortium would have been allowed to collect a special rate call an "all events tariff" allowing Great Plains to repay its debt within five years in the event of product failure. Overall, it is estimated that the coal gas will cost $7.32 per million Btu's as opposed to $3.12 for new natural gas or $5.70 for imported oil. The serious nature of this situation is reflected by the filing of a brief in support of GM by two industrial trade associations representing about 80% of the nations largest corporations. These associations, the American Iron and Steel Institute and the Process Gas Consumers Group are strongly against FERC's rate payer financial plan. The litigation may stall construction of the project. After the lawsuits were filed, the five consortium members tried unsuccessfully to work out an alternative financial scheme. Alternatives were considered because the existing water permit for the project would have expired this past fall if construction has not begun. The coal to gas plant, originally planned for

BEULAH-HAZEN MINE (continued)

a construction start in April 1980 and production in December 1983, will probably not be producing any gas until late 1984.(6)

When operational, the gasification project will require around 4.7 million tons of lignite annually from the Beulah-Hazen mine. Great Plains has recently signed a cogeneration agreement to supply Basin Electric with coal fines, which would otherwise be a waste product in the gasification process. In return for the coal fines the power plant will provide Great Plains with electric power. The coal fines will constitute 50 percent of the coal requirements of the Antelope Valley Station. Thus, when both 440 MW units and the coal to gas facility are on line, Coteau will be under contract to supply 7.2 million tons of lignite per year. At this production level, the Beulah-Hazen mine would be, by far, the largest coal producing mine in North Dakota.(7,8)

At this time, the Great Plains consortium plans to build another 125 mcf/day unit at the site. Construction of this second gasification facility will probably not begin until the operational capabilities of this first unit are demonstrated (i.e., sometime after 1984). This second unit has already been reviewed by all the appropriate state agencies and has received all the permits necessary for construction. Providing that obstacles to the development of the first facility are overcome and appropriate financial backing is available, the second unit could be operational before 1990. This plant would require an additional 4.7 million tons of lignite per year. Thus, production at the mine site would have to increase to almost 12 million tons per year if all the facilities were to be adquately supplied.(9)

Basin Electric also has plans to add a third unit to the Antelope Valley Station. Discussions have also been held concerning the addition of two more 125 mcf/day coal gasification units to the site. The production levels required to fuel the total complex would be in excess of 20 million tons per year. If a North American advertisement that appeared in the 1979 volume of the Keystone Manual is accurate, Coteau has enough in-place reserves (3 billion tons) to fuel the expanded complex for over 120 years. (10,11)

Although the amount of reserves do not appear to be a constraint to additional development at the site, other factors may prohibit development of the three additional facilities. In the first case, demand for the additional electric power generated by the Antelope Valley No. 3 unit appears to have diminished, at least temporarily. Secondly, air quality increments may not be available at the Theodore Roosevelt National Park. This development constraint became apparent when Basin Electric filed an application for a permit to construct the Antelope Valley Station No. 1 and 2 units with the North Dakota State Department of Health. At that time, EPA's state-of-the-art models were used to measure sulfur dioxide emissions. The models predicted that emissions from the Antelope Valley Stations would increase SO_2 concentrations above allowable increments in Class I areas (i.e., the park). The model accounted for existing SO_2 concentrations at the park, as well as the additional concentrations expected from facilities that were previously permitted but are not yet operating. In order to obtain a permit to construct the twin generating plants, Basin Electric was forced to design the plant with more efficient SO_2 removal equipment. Clearly, the State Department of Health's interpretation of the model will be crucial to future development at the Beulah-Hazen site as well as the rest of west central North Dakota.

BEULAH-HAZEN MINE (continued)

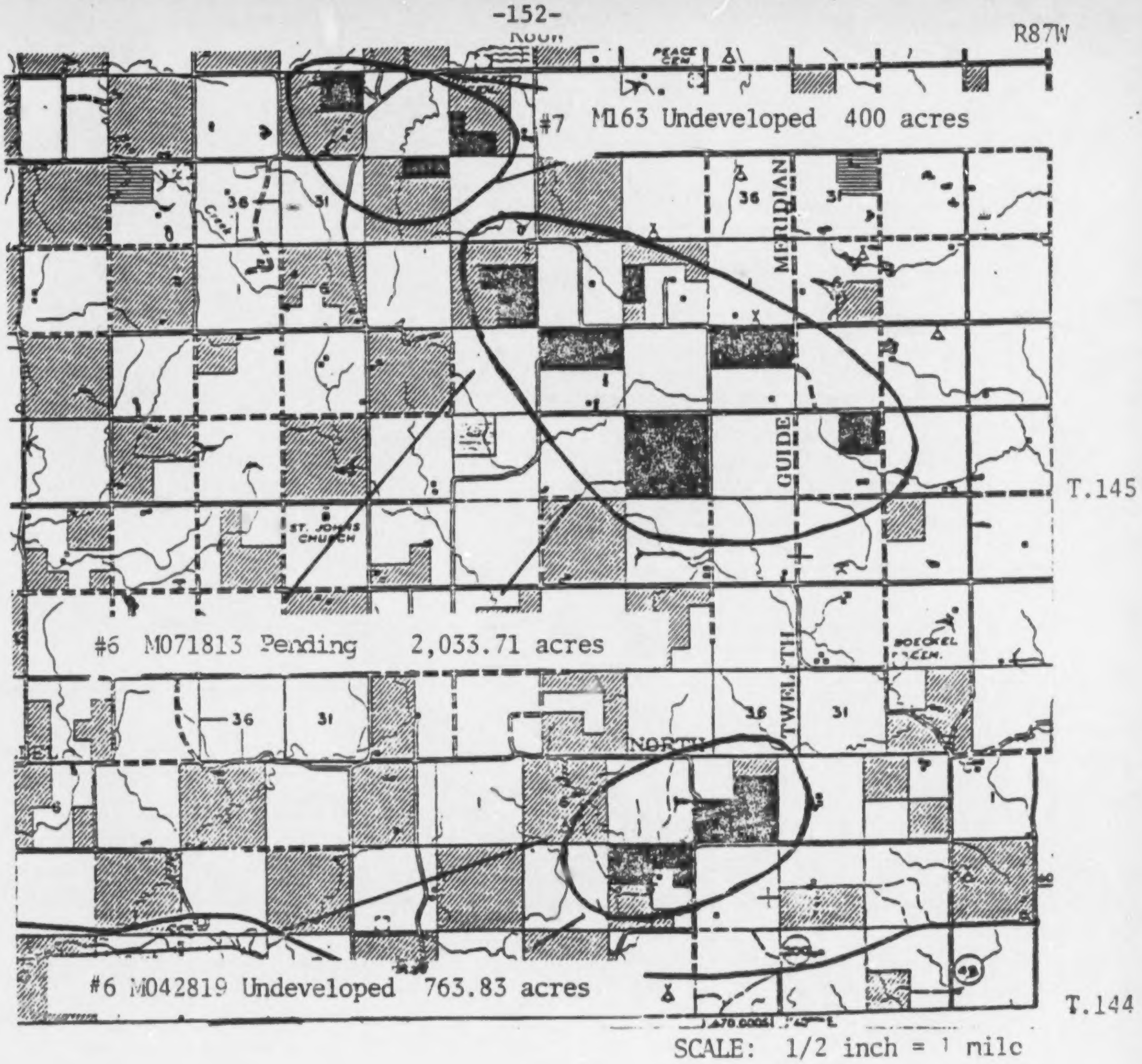
At present, the Department of Health is still evaluating applications for construction permits throughout the area. One of the permits pending approval is Basin Electric's Antelope Valley No. 3 station. No permit application has been filed for the two additional synfuels units. The Department of Health has been repeatedly criticized in this case for using a short range air quality model to predict long range (i.e., greater than 150 miles) effects; however, in the absence of EPA acceptance of a guideline long range model, the Department had little choice. Development in the state is expected to be stymied unless this issue is resolved.(12,13)

The Public Service Commission has granted Coteau a permit to mine small portions of the project area. The permit (No. 46) has been amended three times and allows for pre-mining activities and the mining of coal in and around the area where the tipple is being constructed.(14)

On January 31, 1980 Coteau filed a mine permit application with both the North Dakota Public Service Commission and the U.S. Office of Surface Mining. The application requested permission to mine portions of 2,146 acres. The application was subsequently amended, reducing the acreage to 1,240 acres of private fee coal and 160 acres of federal coal lands. Later, OSM conducted a preliminary and final Apparent Completeness Review of the application, which was completed in September, 1980. Given the lead time required to have the permit reviewed and approved by the OSM Solicitors Office in Washington and to have the permit signed by the Secretary, it is unlikely that the permit will be granted before January, 1981.(15,16)

As discussed earlier, future production levels at the Beulah-Hazen site will depend on the extent and timing of development of the various coal conversion facilities. It is probable that production of lignite will be directed at fulfilling the requirements of the Antelope Valley No. 1 and 2 units and the first gasification facility up until the late 1980's at which time the second gasification unit could become operational. Thus, production should reach 7.2 million tons per year around 1985 and remain at that level until 1988 when it could expand to about 12 million tons per year. Actual levels of production will depend on whether or not Basin Electric will agree to burn the coal fines generated by the second gasification facility.(17)

When and how much federal coal will be mined from the site will also be a function of the timing and selection of mining sequence as determined by the mine plan. This mine is designed with four distinct pits separated by extensions of the Beulah trench. Coteau holds three leases that are located within the mine project. Only one 160 acre tract of one of the three leases is included in the current 5 year mine plan (M071813). The other two leases will be discussed in the undeveloped lease section of the report.(18)


R87W
#7 M163 Undeveloped 400 acres
MERIDIAN
GUIDE
36
31
ST. JOHNS CHURCH
T.145
#6 M071813 Pending 2,033.71 acres
TWELFTH
NORTH
BOECKEL CEM.
#6 M042819 Undeveloped 763.83 acres
T.144
SCALE: 1/2 inch = 1 mile

Map _

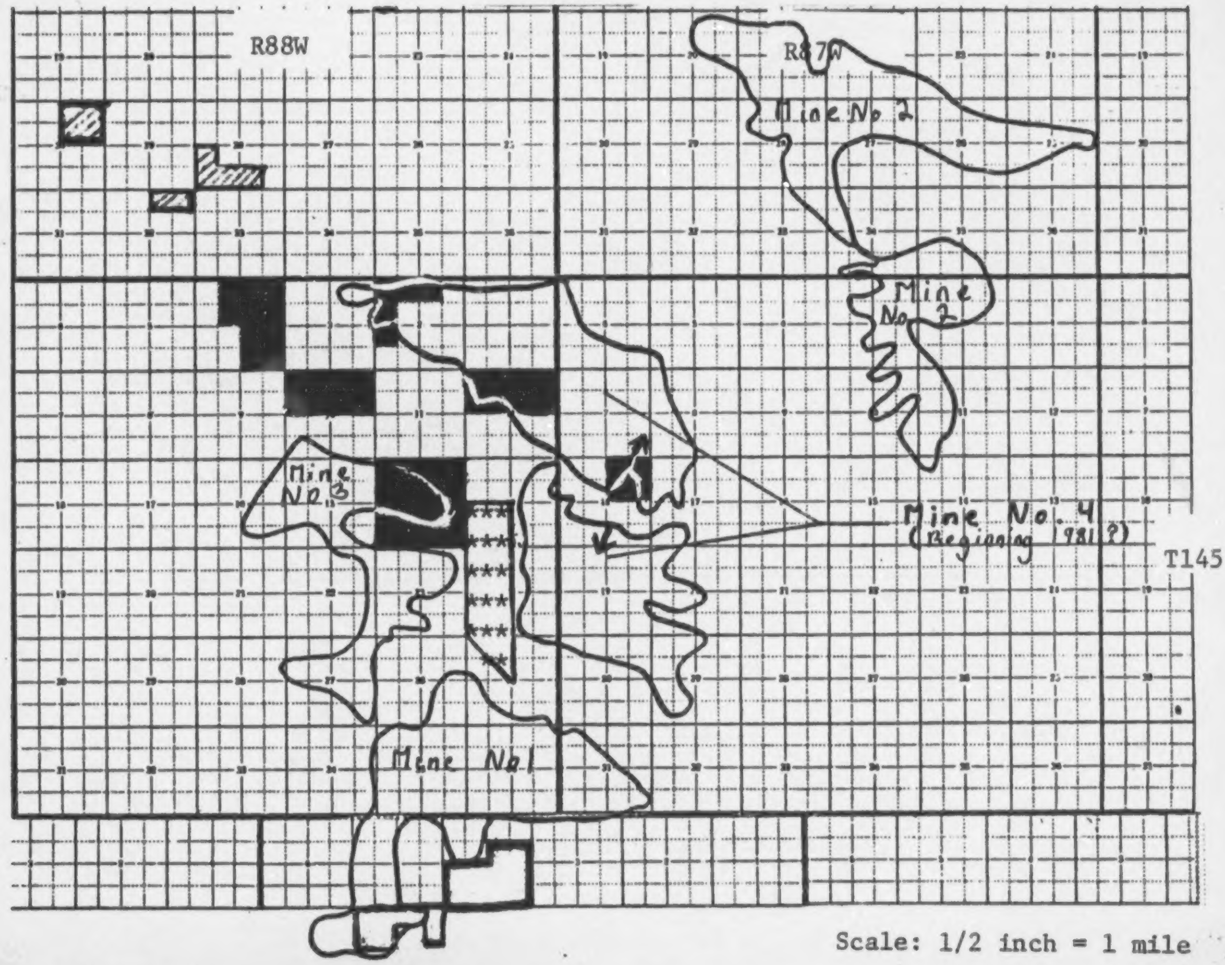
MERCER COUNTY *

BLOCK #6 COTEAU PROPERTIES, INC./BEULAH-HAZEN MINE
BLOCK #7 COTEAU PROPERTIES, INC./BEULAH-HAZEN MINE

*See following map for detail of mining activity

Undeveloped** = Associated with leases in mine plans

MAP ____*
MINING ACTIVITES, BLOCKS #6
COTEAU PROPERTIES/BEULAH HAZEN MINE


R88W
R87W
Mine No 2
Mine No 2
Mine No 3
Mine No. 4
(Beginning 1981?)
T145
Mine No 1

Scale: 1/2 inch = 1 mile

Key

▨ M163, Undeveloped

■ M071813, Developed

□ M042819, Undeveloped

Proposed Mine Limit
With Direction of Advance

*** Power Gasification Plant*

*Source: William B. Hansen;
USGS, Billings, Montana

1. U.S. Office of Surface Mining. Initial Inspection Report. Coteau Properties Company, August 24, 1978.
2. The North Dakota Lignite Council "Facts About North Dakota Lignite." 1978.
3. Energy ERA Newsletter "ANG-Basin Electric Sign Power Supply Agreement." Bismark, North Dakota, October 31, 1980.
4. American Gas Association "Gas Update: Large-scale coal gasification beings in North Dakota." The Washington Post, August 28, 1980 (paid advertisement) pg. A-25.
5. The North Dakota Lignite Council, op. cit.
6. Energy ERA Newsletter. "Consortium Assessing Options for Great Plains Gasification Plant." Bismark, North Dakota, January 31, 1981.
7. American Gas Association, op. cit.
8. Energy ERA Newsletter "ANG-Basin Electric Sign Power Supply Agreement." Bismark, North Dakota, October 31, 1980.
9. American Gas Association, op. cit.
10. U.S. Department of the Interior, Bureau of Land Management. Draft West-Central North Dakota Regional Impact Statement on Energy Development, January 1978.
11. 1980 Keystone Coal Industry Manual. McGraw-Hill, 1980.
12. U.S. Department of the Interior, op. cit.
13. Gene Christiansen, North Dakota Department of Health. Interview comments, September 1981.
14. Coteau Properties Company, Application for Permit to Engage in Surface Coal Mining Operations. North Dakota Public Service Commission, Bismark, North Dakota, January 23, 1980.
15. Ibid.
16. U.S. Department of the Interior, Office of Surface Mining. Apparent Completeness Review--Coteau Properties Company, Beulah-Hazen Mine. September 1980.
17. North American Coal Corporation "We're uncovering a 4.4 billion ton deposit in North Dakota," 1980 Keystone Coal Industry Manual (paid advertisement) 1980).
18. William B. Hansen, U.S. Geological Survey, Billings, Montana. Interview comments.

LEASE BLOCK: 8

MINE NAME: Falkirk Mine

LEASE NO: M31053(ND)

LOCATION: Underwood, North Dakota

LESSEE: Falkirk Mining Company; subsidiary of North American Coal Company

SPECIFIC LOCATION: T146N, R82W

FIRST COAL SHIPPED: 1978

MINE LIFE: 50 years

1979 PRODUCTION: 1,795,211 tons

MINING METHOD: Strip

PROJECTED PEAK PRODUCTION: 5.6 million tons/year

TOTAL PERMITTED ACREAGE: 1,783.1 acres

TOTAL DISTURBED ACREAGE:

PENDING ACTIONS: Mine permit application filed May, 1980 (2,090 acres including 160 acres of federal coal pending approval from U.S. OSM and North Dakota Public Service Commission.

COAL DATA

RANK: Lignite

FEDERAL RESERVES:
IN PLACE:

NAME: Hagel Bed
(Upper Underwood)

RECOVERABLE:

AVERAGE THICKNESS:

AVERAGE OVERBURDEN:

SEAM DIP: 11 feet per mile

OVERBURDEN RATIO:*

BTU/LB: 6,500

% SULFUR: 0.65

*Based on averages of seam thickness and overburden depths

NOTES:

- Falkirk Mine has a 35 year contract to supply coal to the Coal Creek Generating Station which is owned by Cooperative Power Association and United Power Association.
- Permit application on file with OSM is being delayed over concern about spoil pile subsidence and possible disruptions of the water supply for the town of Underwood.
- In the event that the mining permit is not approved in a timely manner the federal coal may possibly be bypassed.

FALKIRK MINE

In 1975, Falkirk Mining Company filed an application with the Bureau of Land Management to lease approximately 1,000 acres of federal coal land near Underwood, North Dakota. Processing of the application was underway in 1977 when the NRDC v. Hughes decision enjoined most federal coal leasing activity.(1)

In 1979, Falkirk amended the lease application in accordance with DOI's new short-term, emergency leasing criteria. In the interim, Falkirk was requested by the town of Underwood to move its existing operation from south of the community to a location directly west of its borders. Underwood requested this action so that Falkirk's mining operations would not interfere with the town's development plans. As it turned out, there was one 160 acre tract of federal coal situated in the area that the citizens had selected for mining. There appears to be little that Falkirk can do to avoid mining the federal tract, at least not in an economical manner. Although the lease became effective in August, 1980, the government has not yet informed Falkirk as to when the mining plan might be approved.(2,3)

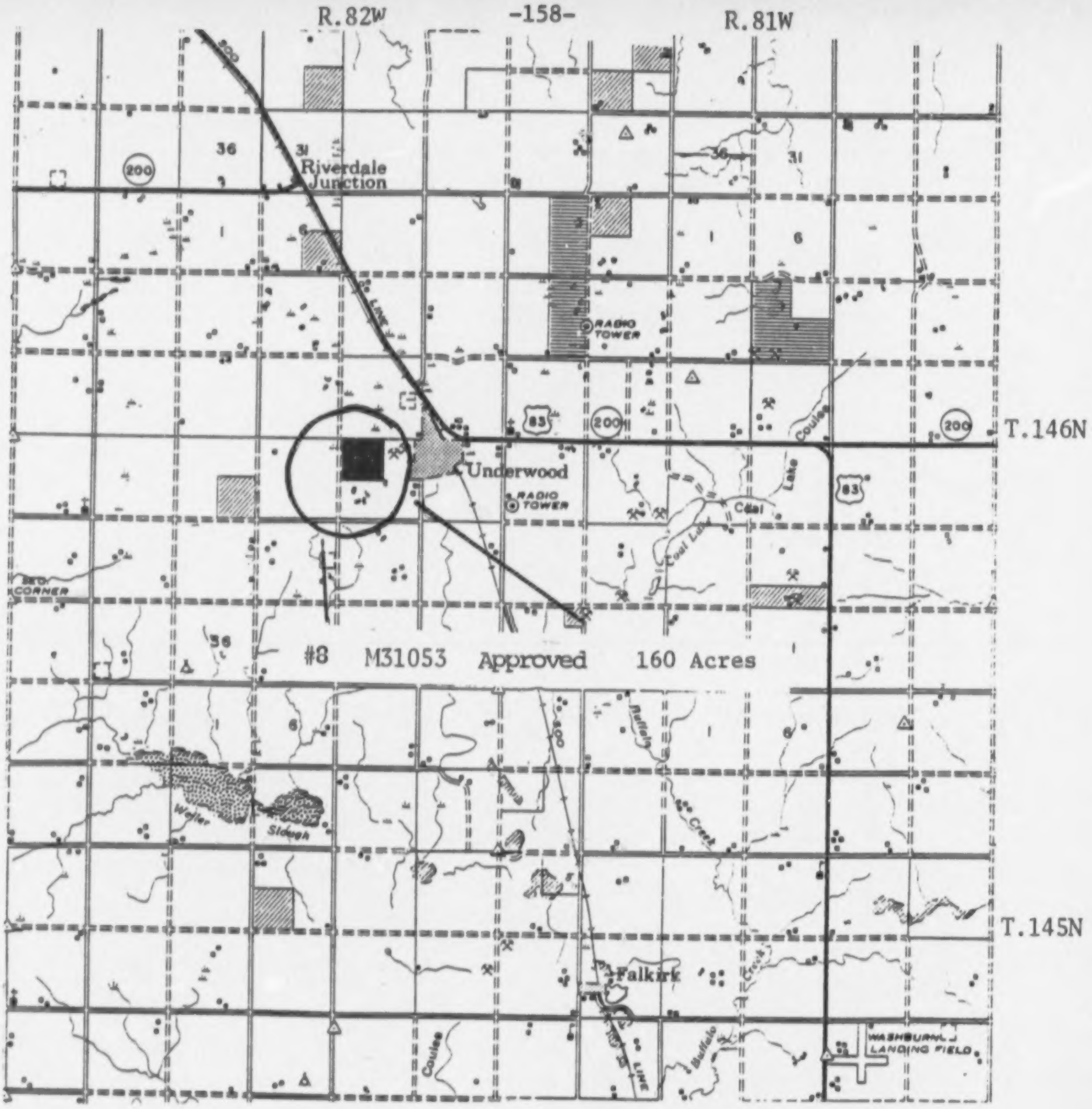
Falkirk's mining operations will cover an area totalling approximately 2,090 acres. This includes the 160 acres of federally leased coal lands. Total recoverable lignite reserves are estimated at tons; whereas recoverable federal reserves are approximately tons. Total mine life is estimated at 50 years. The federal lease is expected to require about six months to mine. In 1979, their first full year of production, 1.8 million tons of lignite was extracted from the mine. Peak capacity is estimated to be roughly 5.6 million tons/year, and the mine is projected to reach this production level by 1985. This level of coal production is required for Falkirk to meet its 35 year contractual obligations with the nearby Coal Creek Generating Station.(4,5,6)

The coal is burned at this mine-mouth generating facility and the resulting electrical energy is transmitted across approximately 425 miles of North Dakota and Minnesota land via a high voltage direct current powerline to Delano, Minnesota. There it is converted to alternating current and fed into cooperative systems located near St. Paul. When the powerline was first planned, the utilities faced stiff opposition from farmers who protested its siting across valuable, privately owned farmland. Siting was eventually allowed under the public utilities authority to claim eminent domain. The underlying discontent remains, however, and has manifested itself with the vandalizing of towers supporting the lines. Similar protests by private land owners and citizen groups could significantly alter, or perhaps preclude, other plans for future mine-mouth generating facilities in North Dakota.(7)

The outcome of Falkirk's federal permit application is of more significance in terms of assessing their immediate development plans at the new site. Early in 1981, Falkirk plans to begin using a 105-cubic yard dragline to remove the 50 to 130 feet of overburden covering the seam. The dimensions of the coal pit will range form 90 to 120 feet in width, and from 0.75 to 1.5 miles in length. The boxcut material will be spoiled on the low wall and will have an angle of repose of approximately 30° to 37°. Depending on the type and depth of overburden encountered, the highwall slopes will vary from 60° to 72°.(8)

The potential for highwall instability and slumping is one of the major factors contributing to delay of Falkirk's mining permit application. As shown in the diagram below, the flow of groundwater is in the same direction as the mining. As a result, seepage into the mine site will be through the spoil, thus tending to destabilize it. The State Public Service Commission is concerned that an inability to control spoil pile slumping at the site may eventually result in a "domino effect" in which large areas behind the spoil, including portions of the reclaimed areas upon which the Underwood township plans to expand, would also slump. (10)

The Public Service Commission wants to know what mitigating measures Falkirk plans to employ if the spoil becomes unstable before they grant approval of the permit application. In addition, the Commission is withholding approval due to concern over the operation's potential disruption of a major aquifer. In this case, the coal seam to be mined is in the midst of an enormous groundwater recharge area. While Falkirk has made commitments to provide alternative sources of water if Underwood's ground supplies are disrupted, the extent of impacts beyond the immediate area has not been identified. The potential effects are of particular concern in this area of North Dakota since 60 to 70 percent of the domestic and stockwells obtain water from shallow lignites. Alternative groundwater sources are not readily available as they generally occur at depths of over 1,000 feet below the surface. At this time, the stipulations that the PSC and/or OSM will impose on Falkirk when the application is finally approved are unknown.


R.82W
R.81W
T.146N
T.145N
Riverdale Junction
Underwood
Falkirk
RADIO TOWER
RADIO TOWER
200
83
Coal Lake
Weller Slough
WASHBURN LANDING FIELD
#8 M31053 Approved 160 Acres

SCALE: 1/2 inch = 1 mile

MAP __

McLEAN COUNTY

Block #8 FALKIRK MINING CO./FALKIRK MINE

1. U.S. Department of the Interior, Bureau of Land Management. *Land Use Analysis--Technical Examination Environmental Assessment: Falkirk Mining Company Coal Lease Application M31053(ND)*. July 1979.

2. Ibid.

3. James Brown, North American Coal Corporation, Bismark, North Dakota. Interview comments, September 1980.

4. U.S. Department of the Interior, op. cit.

5. North American Coal Corporation "We're uncovering a 4.4 billion ton deposit in North Dakota" 1980 Keystone Coal Industry Manual (paid advertisement) 1980.

6. *1980 Keystone Coal Industry Manual*. McGraw-Hill, 1980.

8. Falkirk Mining Company, *Surface Coal Mining Permit Application*. May 12, 1980.

9. Ed Englerth, North Dakota Public Service Commission. Interview comments, September 1980.

10. Ibid.

11. Ibid.

12. Groenwold, Gerald H., et al., *Depositional Setting and Groundwater Quality in Coal Bearing Sediments and Spoils in Western North Dakota*. 1981.

MINE NAME: Gascoyne Mine

LOCATION: 4 miles southeast of Scranton, North Dakota

SPECIFIC LOCATION: T131N, R99W

FIRST COAL SHIPPED: 1946

1979 PRODUCTION: 2.8 million tons

PROJECTED PEAK PRODUCTION: 2.8 million tons

TOTAL PERMITTED ACREAGE: 3,283 acres

TOTAL DISTURBED ACREAGE: 1,316 acres

LEASE BLOCK: 10

LEASE NO: BLM019127

LESSEE: Knife River Coal Mining Company; subsidiary of Montana-Dakota Utilities Co.

MINE LIFE: 30 years

MINING METHOD: Strip

PENDING ACTIONS: LMU application filed with USGS has conditional approval.

COAL DATA

RANK: Lignite

NAME: Harmon

AVERAGE THICKNESS:

SEAM DIP: Less than 1°

BTU/LB: 6,200

% SULFUR: 0.75

FEDERAL RESERVES:
IN PLACE:

RECOVERABLE:

AVERAGE OVERBURDEN:

OVERBURDEN RATIO:*

*Based on averages of seam thickness and overburden depths

NOTES:

- Knife River has contracts to supply lignite to two power plants and a leonardite processing facility.
- Special covered hopper cars and handling facilities were designed and built for delivery of 2.5 million tons of lignite per year to the Big Stone Partners power plant located 300 miles from the Gascoyne Mine.
- The portion of track now serving the mine and its markets is in danger of being severed from the bankrupt Milwaukee Road Rail holdings. If the integrity of the track is not maintained, the mine would be forced to shut down.

GASCOYNE MINE

The Gascoyne mine is owned and operated by a local company, the Knife River Coal Mining Company (KRCMC). The company is a subsidiary of Montana Dakota Utilities (MDU) which is also one of the principal consumers of coals produced by Knife River. The mine was purchased from the Helms brothers in 1952 who started the small independent operation in 1946. The mine is located along the eastern extremities of Bowman County which is found in the southwestern corner of North Dakota. The main line of the Chicago, Milwaukee, St. Paul and Pacific Railroad (simply known as the Milwaukee Road), and U.S. Highway 12 parallel the mine to the south and pass through Scranton, a town about four miles northwest of the mine site.(1,2)

Knife River originally acquired the project area in order to fulfill lignite requirements for an expanded MDU power plant located in Mobridge, North Dakota. Within the planned mining area were a number of tracts of federal coal which were leased to the company in 1951. Subsequent expansion of the mine resulted in lease modifications which eventually increased the size of federal lease BLM019127 from 1,440 acres to over 2,000 acres. Production from the federal lease began in 1956. Today the mine supplies lignite to two power plants including Otter Tail Power Company's Ortonville plant, and the relatively new Big Stone Power Plant (1974) owned by a partnership of utilities including both MDU and Ottertail Power Company.(3,4)

The Gascoyne Mine also supplies approximately 60,000 tons of leonardite per year to a nearby American Colloid processing plant. The leonardite, which is a highly oxidized lignite is used as a component of oil well drilling muds and as a water softener in large boilers. Knife River estimates that it has enough leonardite reserves at the site to supply American Colloid's processing plant for the next 50 years. The availability of a large quantitiy of leonardite reserves at the Gascoyne site may have been an overriding factor in the Knife River's 1978 decision to relinquish a federal lease (M025702) consisting solely of leonardite or "slack" reserves. The relinquished lease area is located a couple of miles east of the Gascoyne mine.(5,6)

At this time, Knife River ships all lignite mined as a fuel by rail. Annual shipments include approximately 2.5 million tons to the Big Stone Power Plant located 350 miles away in South Dakota and a hundred thousand tons to Otter Tail Power's Ortonville Power Plant in Minnesota. This tonnage, combined with the lignite shipped from Knife River's South Beulah mine, make the company the largest shipper of coal in North Dakota. Shipping large volumes of lignite can be complicated by the poor handling characteristics of the North Dakota coal. Upon exposure to various combinations of air, moisture and freezing temperatures, lignites tend to slack (i.e., to crumble into fine particles), oxidize and undergo spontaneous combustion. In order to transport the large volumes of lignite required by the Big Stone Partner's 410 MW generating facility (the first real attempt at shipping more than a million tons of lignite a year further than 100 miles) special covered hopper cars and loading/unloading facilities were designed and built. Financed by the utility partnership, this apparently successful program has been the first and last significant attempt at exporting millions of tons of lignite to regions outside of western North Dakota.[7]

GASCOYNE MINE (continued)

Although handling characteristics of lignite increase its shipment costs, the price of lignite delivered from Gascoyne has remained competitive with other fuels. And, while the question of transportation costs has not deterred the use of Gascoyne lignites, the ability to transport the lignite via the rail line serving the mine may prevent its use. Transportation is an issue due to the potential closing of the rail link between the mine and its markets. The portion of track in question is now serving the Big Stone Power Plant and the Gascoyne Mine. The road bed is owned and operated by the Milwaukee Road. About 350 miles of the Milwaukee Road track provide an avenue for unit train deliveries to the power plant from Gascoyne. If the integrity of the track is not maintained, both the mine and the power plant would be forced to close down. Other consuming facilities would also be affected to varying degrees. The Milwaukee Road is bankrupt and is currently under the jurisdiction of the Federal Bankruptcy Court. The railroad company has already amputated that portion of its system west of Miles City, Montana. The possibility of severing further rail service, including all services west of Minneapolis-St. Paul is very real according to operators of the power plant. Recently, the Milwaukee Road Trustee requested a new freight rate, which would increase the price of transporting the lignite to the power plant by 65 percent. The Big Stone partners found this unacceptable since the railroad trustee was unwilling to make assurances that any portion of the higher rate would be used to maintain the roadbed between the mine and the power plant. There is still a great deal of uncertainty concerning a decision to maintain or terminate service along this linkage.(8,9)

In the interim, various measures have been taken to improve the 350 mile section of track which is considered to be in worse shape than any other stretch of track still maintained by the railroad. Attempts are being made to reorganize the railroad company's management structure and both North Dakota and South Dakota are spending millions of U.S. dollars allocated to them under the U.S. Railroad Recovery Act to maintain the track in operating order. In the event that the Milwaukee Road does abandon the track, another rail company could possibly take over its control. Both Burlington Northern and Union Pacific have already taken responsibility for some of the western tracks previously severed by the Milwaukee Road.(10)

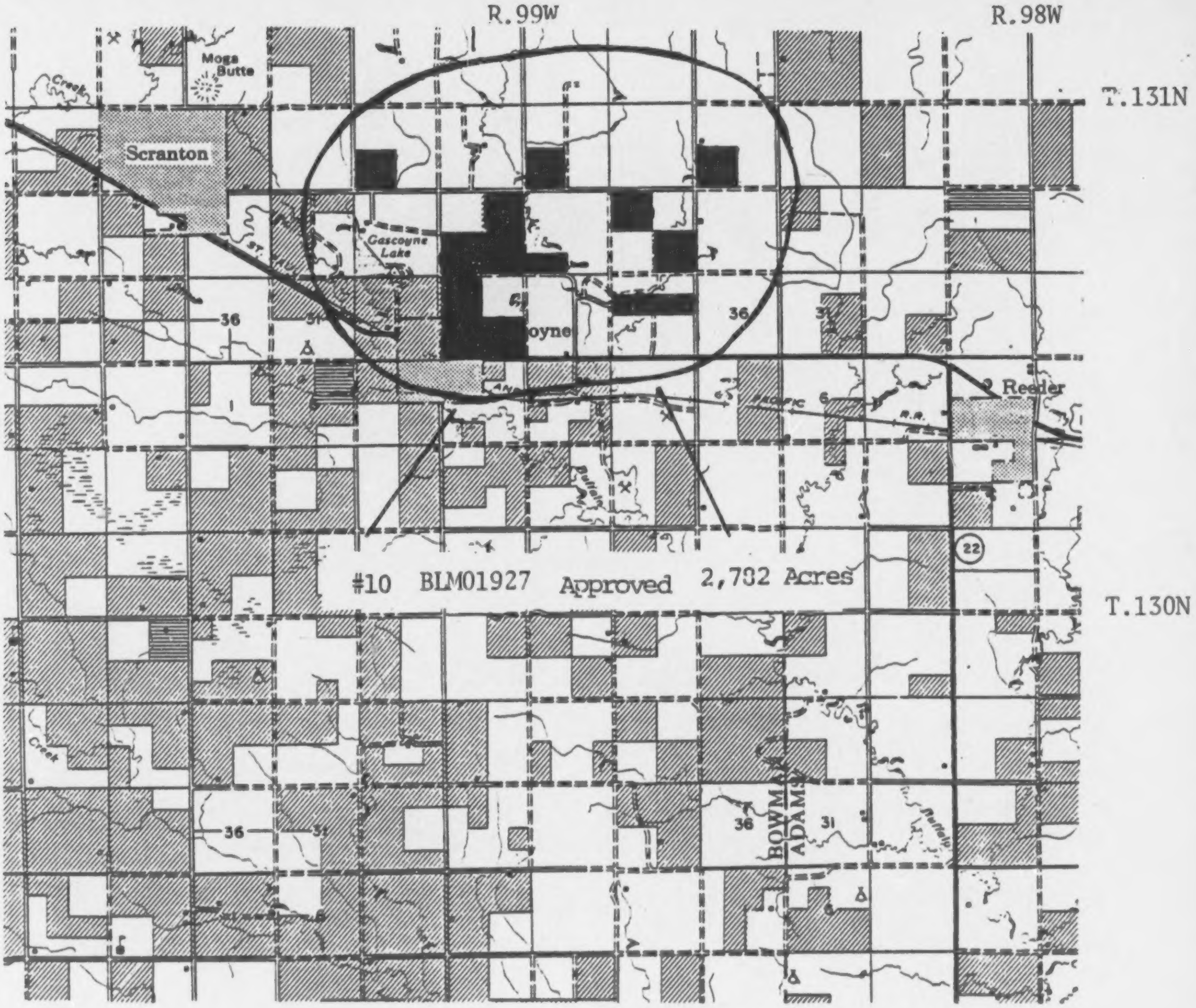
Overall, the issue of transportation is apparently the only real major constraint to continued production of lignite at the site. With few exceptions, mining conditions are excellent. The topography of the area consists of gently rolling plain with mineable coals found in deposits of two and three seams totalling 9 to 33 feet in thickness. Overburden averages only 40 feet and is only 80 feet at its maximum. Knife River uses a dragline with a 32 cubic yard bucket on a 235-foot boom in its overburden removal operations. The dragline rotates between three or four existing pits during a given year. This procedure is followed in order to expose, simultaneously, lignites containing both relatively high and low concentrations of sodium. Knife River blends its low sodium lignite with higher sodium lignites in order to produce a fuel which includes less than

4 1/2% sodium by weight. In order to augment blending requirements, the company maintains stockpiles consisting of around a million tons.(11,12)

Knife River's mining procedures, designed to control sodium concentrations (i.e., mining from three to four pits at one time), appear to have been a major contributor to negative publicity concerning the company's reclamation program. The criticism came in Inform, Inc.'s 1980 publication Reclaiming the West by Daniel P. Wiener. Out of 15 western mines addressed in the report, Knife River's Gascoyne Mine was rated as having the worst reclamation of all. The rating, was based on the proportion of mined lands which have been reseeded at Gascoyne, not the success of Knife River's past reclamation efforts. Whether or not Inform's accusations are appropriate, it appears that the report will not have any impact on future lignite production at Gascoyne. The North Dakota Public Service Commission, the state agency responsible for regulating reclamation, acknowledged that reclamation progress at KRCMC's mine had been slow, but felt it was not proceeding much slower than mining conditions warranted. Mining from four different pits directly affects the amount of time it takes for mining activities to proceed far enough along to initiate reclamation procedures.(13,14)

In terms of actual production of federal coals, KRCMC has experienced a several problems. The occurrence of a high water table in the area of the mine has caused slumping of spoils and of the natural highwall in Section 28 (See Map VI-10). This is the only section of federal coal that is likely to be mined in the near future. Ground water in this area flows into the mine site in a southwesterly direction towards Gascoyne Lake. KRCMC is also experiencing some problems with seepage of waters into the mining area from Gascoyne Lake (i.e., from the opposite direction). Although the influx of waters into a mine can create hazardous working conditions and mitigation/control measures can add to the cost of mining, these factors have apparently not yet affected the mining of federal coal. On the other hand, the unwillingness of a surface owner of the NE 1/4 of Section 33 to allow mining on his lands has prevented production of some federal coal. As can be seen on Map ____ the quarter section borders three of the producing Gascoyne mine pits. It is an area that still can be mined in logical sequence.(15,16)

Aside from the exceptions noted above, Knife River has experienced few problems with the potential to prohibit the mining of coal from the area. As shown on Map VI-10, with exception to the mining of Section 28 and 32, all of the near-term mining activity at the Gascoyne mine will occur on fee lands. With this in mind, Knife River has filed a Logical Mining Unit application with the U.S. Geological Survey in order to maintain acceptable diligence production levels. This is the only company that has taken this step in North Dakota to date. At this time, the USGS has conditionally approved the application. This step will allow Knife River to continue mining in a logical progression until it eventually reaches federal coal areas. Thus, while the company is likely to meet due diligence standards, it is unlikely that KRCMC will mine much federal coal in the near-term. But, given that a high percentage of the company's reserves at the site are federal lignite, it is expected that a great amount of federal coal will be mined in the mid- to long-term.(17)


R.99W
R.98W
T.131N
T.130N
Moga Butte
Creek
Scranton
Gascoyne Lake
oyne
36
31
36
31
Reeder
Pacific
R.R.
22
#10 BLM01927 Approved 2,782 Acres
Creek
36
31
36
31
BOWMAN
ADAMS
Buffalo

SCALE: 1/2 inch = 1 mile

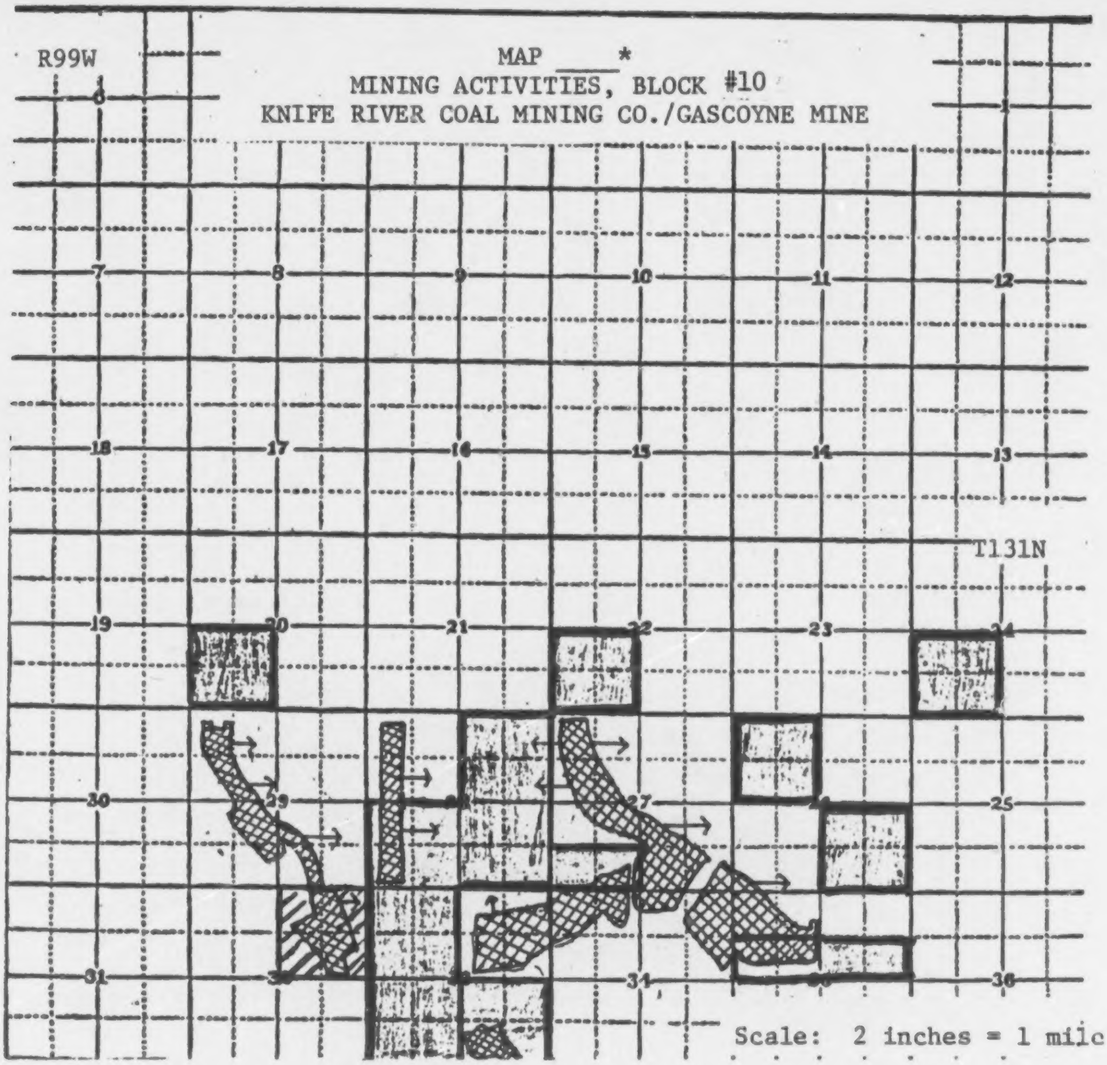
MAP __

BOWMAN COUNTY

BLOCK #10 KNIFE RIVER COAL MINING CO./GASCOYNE MINE *

*See following map for detail of mining activities

MAP ____*
MINING ACTIVITIES, BLOCK #10
KNIFE RIVER COAL MINING CO./GASCOYNE MINE


R99W
T131N
6
1
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8
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17
16
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23
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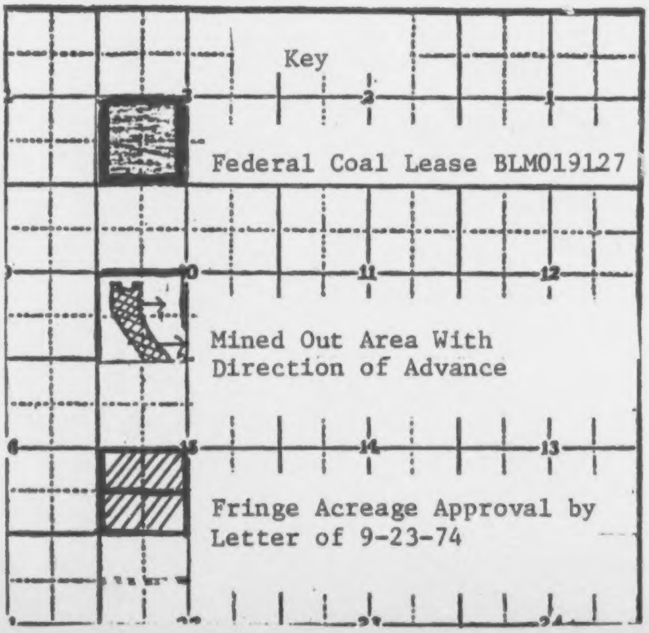
32
34
36

Scale: 2 inches = 1 mile

*Source: William B. Hansen
USGS, Billings,
Montana


Key
10
11
12
15
14
13

▨ Federal Coal Lease BLM019127

Mined Out Area With Direction of Advance

Fringe Acreage Approval by Letter of 9-23-74

1. Knife River Coal Mining Company. Gascoyne Mine Mining and Reclamation Plan--Environmental Analysis. December 1975.
2. Knife River Coal Mining Company. Mining and Reclamation Plan for the Gascoyne Mine. Submitted to the United States Geological Survey. January 1977.
3. Knife River Coal Mining Company. December 1975, op. cit.
4. National Coal Association, Steam Electric Plant Factors, 1979.
5. Alan Mace, Knife River Coal Mining Company. Interview comments, September 1980.
6. 1980 Keystone Coal Industry Manual. McGraw-Hill, 1980.
7. Alan Mace, op. cit.
8. U.S. Department of Energy, Assistant Secretary for Resource Applications. Energy Impacts of Proposed Milwaukee Railroad Abandonments. October 1979.
9. Energy ERA Newsletter, "Milwaukee RR May Abandon Minnesota to Montana Line." Bismark, North Dakota, January 31, 1981.
10. Ed Englerth, North Dakota Public Service Commission. Interview comments, September 1980.
11. Knife River Coal Mining Company. January 1977, op. cit.
12. Alan Mace, op. cit.
13. Wiener, Daniel P. Reclaiming the West, Inform, Inc. 1980.
14. Ed Englerth, op. cit.
15. Alan Mace, op. cit.
16. William B. Hansen, U.S. Geological Survey, Billings, Montana. Interview comments, September 1980.
17. Ibid.

MINE NAME: South Beulah Mine

LOCATION: Mercer & Oliver Counties,
North Dakota

SPECIFIC LOCATION: T143N; R87&88W

FIRST COAL SHIPPED: 1963

1979 PRODUCTION: 1.8 million tons

LEASE BLOCK: 12

LEASE NO: M041765, M43083

LESSEE: Knife River Coal Mining Company; subsidiary of Montana-Dakota Utilities Co.

MINE LIFE: 35 years

MINING METHOD: Strip

PROJECTED PEAK PRODUCTION: 4 million tons/year

TOTAL PERMITTED ACREAGE: 3.449

TOTAL DISTURBED ACREAGE: 1.210

PENDING ACTIONS: None

COAL DATA

RANK: Lignite

NAME: Beaulah-Zap Bed

AVERAGE THICKNESS:

SEAM DIP: Less than 1°

BTU/LB: 6757

% SULFUR: 0.99

FEDERAL RESERVES:
IN PLACE:

RECOVERABLE:

AVERAGE OVERBURDEN:

OVERBURDEN RATIO:*

*Based on averages of seam thickness and overburden depths

NOTES:

- No major constraints to mining have been identified at this site.

- Production from the site is currently supplying three existing generating plants. KRMC plans to expand production to fuel a new 410 MW mine-mouth facility when it comes on line in May, 1981.

SOUTH BEULAH MINE

Knife River Coal Mining Company's South Beulah Mine is located approximately two miles south of the town of Beulah. Almost 1.8 million tons of coal are extracted annually from the mine. The South Beulah Mine currently supplies coal to three electricity generating plants. Some of the coal is consumed at the site in Montana Dakota Utilities (MDU) Beulah plant (approximately 80,000 tons per year). Most is shipped to MDU's Heskett #1 and #2 (approximately 0.6 million tons per year) and to Otter Tail Power Company's Hoot Lake power plant in Fergus Falls, Minnesota (approximately 700,000 tons per year). The South Beulah mine is currently expanding production in order to supply lignite to the new Coyote I, 410 MW, mine-mouth facility. Construction of this facility, financed by a consortium of five utilities including MDU has already been completed. Coyote I will require 2 million tons of lignite annually when it is finally brought on line in May, 1981. (At that time, MDU's Beulah facility will be phased out.) Including production necessary to fulfill lignite requirements of various sugar beet refineries, Knife River will be required to extract close to four million tons annually from its South Beulah operation.(1,2)

Originally, KRCMC planned to dedicate all of South Beulah's production to the Coyote I and eventually Coyote II mine-mouth facilities. Knife River's New Leipzig project area was scheduled to be in operation to supply those utility and industrial plants currently fueled by the South Beulah mine. Instead, the New Leipzig plans have been suspended due to transportation constraints. Also, the Coyote II plant doesn't appear likely to receive an air permit due to the unavailability of sulfur dioxide increments at nearby Theodore Roosevelt National Park. (Unless the Coyote Partners can reduce the combined emissions of Units 1 and 2 to the levels now emitted by Unit 1. Thus, it is probable that South Beulah's production will remain committed to existing consumers (less MDU's Beulah power plant) and the Coyote I plant.[3,4,5]

Knife River currently holds two federal leases in the South Beulah area. The first (M041765 (ND)) was granted in August of 1961 and covers 1,600 acres of land. The second (M43083 (ND)) includes only 80 acres and was granted to Knife River under the BLM's emergency coal leasing program during October of 1980. Knife River has been extracting coal from the South Beulah site since 1963. The first federal coal produced at the mine was dug in the same year. Except for 1975, Knife River has produced some coal from the lease every year since the mine was first opened. But, federal coal has only been mined from two of the ten noncontiguous plots that make up the larger lease. A mine plan revision approved by the state of North Dakota in 1977 indicated that coal will continue to be mined from the two producing federal plots. There are still no plans filed for extracting coal from the remaining eight. So far, mining has occurred in Sections 2 and 14 of the federal lease (See Map VI-12). Section 2 has been mined-out and Knife River expects to be extracting lignite from Section 14 for 10-15 years. Expanded levels of production could possibly accelerate production on the remaining lease plots. Mining from the new lease area is expected to begin as soon as the mine plan application is approved by OSM.(6,7,8)

Up to this time, no major constraints to continued mining at the South Beulah Mine have arisen. Except for the somewhat gentler topography, the

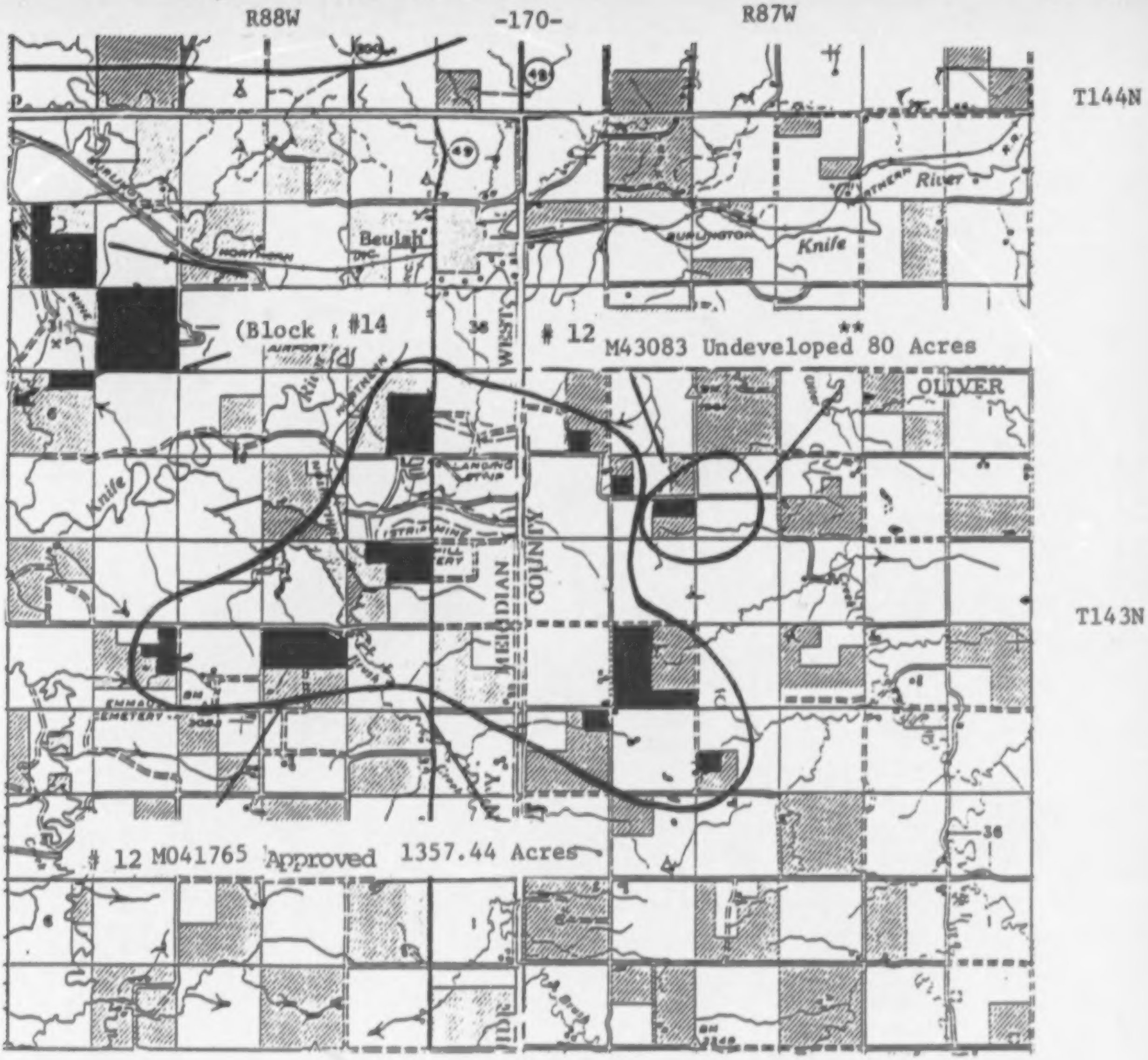
SOUTH BEULAH MINE (continued)

mining characteristics are very similar to North American's Indian Head Mine. While there are a few surface areas of high sodium concentrations, most of the mine area consists of former cropland. These areas are much less difficult to reclaim than rangelands which have inherently poor soil characteristics.(9)

The deposit currently being mined at the site includes both the Schoolhouse and Beulah-Zap beds. This deposit consists of three mineable seams ranging from   to   feet thick with an average of   feet of interburden covering the first seam. Between Seam 1 and Seam 2, approximately   feet of overburden is present. Approximately five feet of clay exists between Seam 2 and Seam 3.(10)

The Knife River Coal Mining Company estimates the reserves of the Beulah-Zap bed at about 200 million tons under an average overburden depth of   feet. During the next 20 years approximately 80 million tons of lignite will be surface mined at the South Beulah facility. The estimate is based upon the current production rate of approximately 4 million tons annually. The company estimates recoverable reserves remaining in the tracts covered by Lease M-041765 and included in the planned mine area at   million tons. It has also been estimated that recoverable reserves of around   million tons can be extracted from Lease M-43083.(11)

Removal of the overburden is by a dragline operation involving three draglines carrying TS, 12, and 17 cubic yard buckets. The mining of coal itself at the South Beulah Mine is a shovel-truck operation. After the overburden is removed from the coal bed, it is drilled and blasted to facilitate handling. Coal is loaded into 120-ton capacity haulage units, and hauled to the tipple where it is loaded into railroad cars for shipment.(12)


R88W
R87W
T144N
T143N
Beulah
Knife
River
(Block # #14
# 12
M43083 Undeveloped** 80 Acres
OLIVER
MERCER
COUNTY
MERIDIAN
WEST
# 12 M041765 Approved 1357.44 Acres
Scale: 1/2 inch = 1 mile

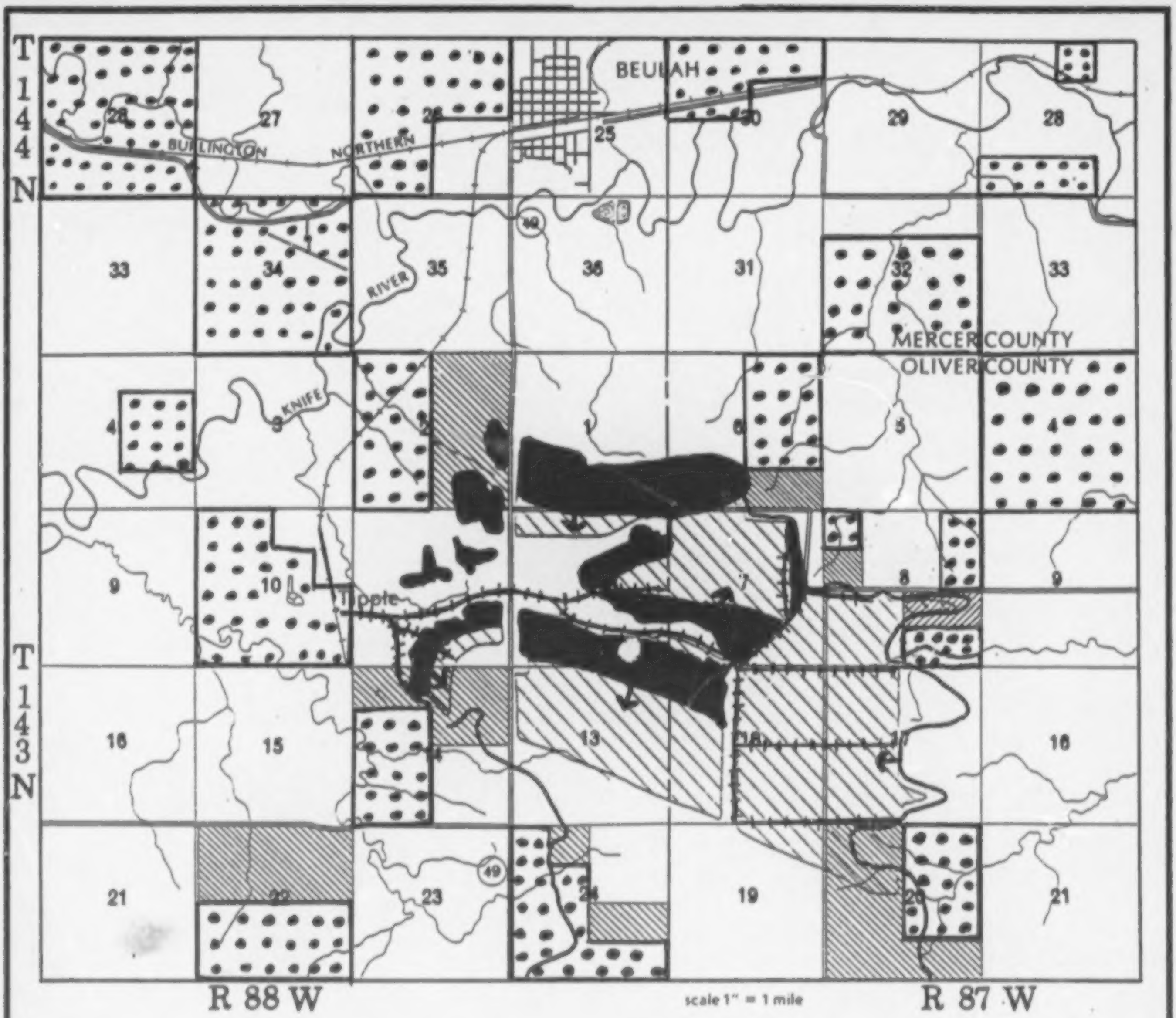
MAP ____

MERCER & OLIVER COUNTIES*

Block # 12 KNIFE RIVER COAL MINING CO./SOUTH BEULAH MINE

* See following map for detail of mining activity.

Undeveloped** = Associated with leases in Mine Plans


T 144 N
T 143 N
BEULAH
BURLINGTON NORTHERN
26
27
28
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30
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28
33
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35
36
31
32
33
RIVER
KNIFE
49
MERCER COUNTY
OLIVER COUNTY
4
3
2
1
6
5
4
9
10
Tipple
7
8
9
16
15
14
13
18
17
16
21
22
23
24
19
20
21
R 88 W
scale 1" = 1 mile
R 87 W

SOUTH BEULAH MINE

LEGEND

⁘ Federal Coal
▨ Federal Coal Lease M 014765
▨ Federal Coal Lease M 43083
■
▨ Existing and Future Mining Area

b Coyote I Power Plant
— Cropline Second Seam
+++++ Haul Road

1. Alan Mace, Knife River Coal Mining Company, Bismark, North Dakota. Interview comments, September 1980.
2. U.S. Department of the Interior, Bureau of Land Management. Draft West-Central North Dakota Regional Impact Statement on Energy Development. January 1978.
3. Alan Mace, op. cit.
4. U.S. Department of the Interior, op. cit.
5. Gene Christiansen, North Dakota Department of Health. Interview comments, September 1980.
6. U.S. Department of the Interior, Automated Coal Leasing Data System, printout dated September 1980.
7. U.S. Department of the Interior, Bureau of Land Management. News Release. Coal Lease Sale Approved for Federal Deposits in Oliver County, North Dakota, July 21, 1980.
8. William B. Hansen, U.S. Geological Survey, Billings, Montana. Interview comments.
9. Ed Englerth, North Dakota Public Service Commission. Interview comments, September 1980.
10. Knife River Coal Mining Company, Application for Surface Mining Permit--South Beulah Mine. Submitted to U.S. OSM, Denver, Colorado, 1977.
11. Alan Mace, op. cit.
12. Knife River Coal Mining Company, op. cit.

LEASE BLOCK: 14

MINE NAME: Indian Head

LEASE NO: BK020373, M34980

LOCATION: 2 miles southeast of
Zap, North Dakota

LESSEE: North American Coal
Corporation

SPECIFIC LOCATION: T143N, R89W

FIRST COAL SHIPPED: 1917

MINE LIFE:

1979 PRODUCTION: 1.1 million tons

MINING METHOD: Strip

PROJECTED PEAK PRODUCTION: 1.1 million tons/year

TOTAL PERMITTED ACREAGE: 2,892 acres

TOTAL DISTURBED ACREAGE: 1,392 acres

PENDING ACTIONS: Mine permit application filed December, 1979 (490 acres of federal coal--no feel coal). Application was approved in September of 1980 but NACCO chose to revise and resubmit the plan to U.S. OSM due to delays in obtaining the original approval.

COAL DATA

RANK: Lignite

FEDERAL RESERVES:
IN PLACE:

NAME: Beulah-Zap Bed

RECOVERABLE:

tons

AVERAGE THICKNESS:

AVERAGE OVERBURDEN:

SEAM DIP: Less than 1°

OVERBURDEN RATIO:*

BTU/LB: 6880

% SULFUR: 1.10

*Based on averages of seam
thickness and overburden depths

NOTES:

- This is a relatively small mine when compared to NACCO's two new mines operated by its subsidiaries.
- Indian Head supplies coal to United Power Associations 192 MW power station in Stanton, located 27 miles east of the mine.
- While one of the Indian Head leases has been mined out (BK020273), mining operations have not begun on the second (M34980).
- Delayed approval of NACCO's mining permit application has served to reduce the amount of federal coals from the new lease area by 0.5 million tons.

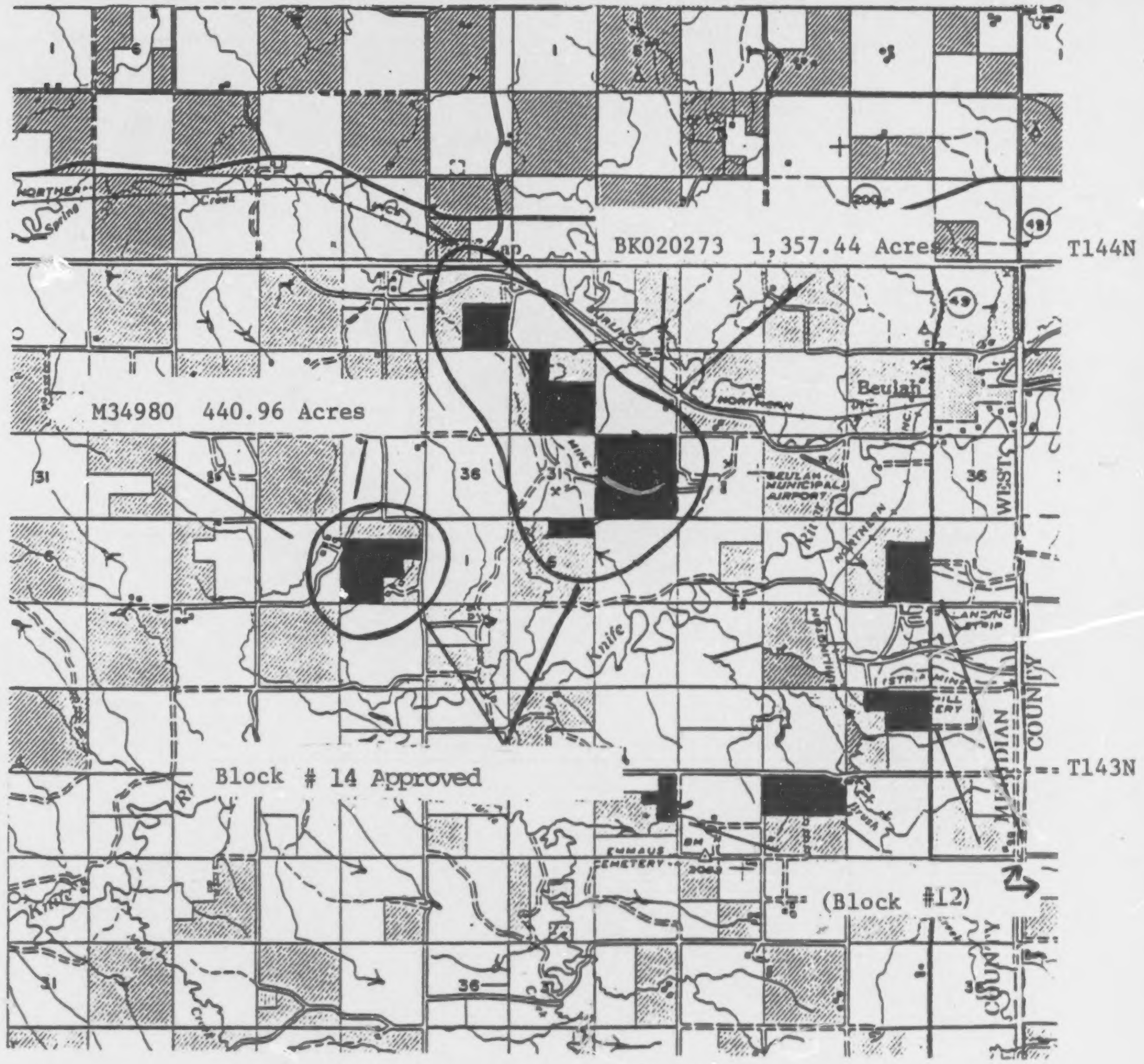
INDIAN HEAD MINE

North American Coal Corporation (NACCO)'s Indian Head Mine is located south and west of the city of Beulah in Mercer County. The township of Zap is about two miles northwest of the mine. NACCO produced approximately 1.1 million tons in 1979 from the Indian Head site. Approximately 800,000 tons were shipped to United Power Association's 192 MW power station in Stanton, located approximately 27 miles east of the mine. Another 300,000 was sold to Basin Electric's Leland Olds Power Plant also located in Stanton. This tonnage was used by Basin Electric to make up for production short falls at Consolidation Coal Company's Glenharold mine. The remainder of the lignite produced at the mine was purchased by local domestic and institutional consumers. At this time, it is unknown if Glenharold's inability to meet contracted production levels will lead to any sort of long-term commitment between Basin Electric and NACCO. If not, it is probable that Indian Head levels of production will return to their pre-1979 levels.(1)

The mine, known as the Lucky Strike Mine prior to 1957, has been operating since 1917. Similar to the Glenharold Mine, lands at the Indian Head site consist of gentle to steeply rolling hills. A number of wooded draws are located between the hills. Unlike the Glenharold mine, NACCO has managed to successfully avoid the necessity of mining through draws in order to maintain existing levels of production. Having noted Consolidation's lack of success in obtaining a permit to mine the draws, NACCO has designed its mining operation to avoid mining near these areas.(2,3)

Unlike North American's subsidiary mine operations (Falkirk Mine Company's Falkirk Mine and Coteau Properties Company Beulah-Hazen Mine), the Indian Head mine area is not covered with extensive deposits of glacial materials. Rather, the site is characterized by an extremely thin layer of topsoil which covers highly sodic overburden. Soil quality at the site is so poor that it will not support farming. Instead, pre-mining use has been limited to range or pastureland. Mining under these conditions presents the potential for several problems including: migration of salts to the surface in reclaimed areas, contamination of groundwaters, as well as the potential for differential subsidence or piping. All agencies concerned with the monitoring of reclamation success have pointed to the Indian Head operation as having the greatest potential for sodium related problems. Northern American, like Consolidation, has a good record concerning attempts to reclaim lands where it is economically viable. Reclamation issues generally arise where mining conditions at a specific site have complicated the ability to reestablish the normal vegetative productivity. In the case of Indian Head, the most effective means of eliminating the potential for sodic problems would be to implement special procedures using clay-like soils to cover and seal off sodic spoils before replacing the original sub and topsoils. The procedures are prohibitively expensive and have not yet been required by either OSM or the State Public Service Commission. While regulatory agencies have raised the issue, mining has not been prohibited. In fact, North American received approval from both state and federal agencies to mine an additional tract of 490 acres of federal coal in September, 1980. The sodium problem, while addressed as an issue in all assessments conducted in the various approval processes, was not determined as a factor significant enough to prohibit mining.(4,5,6)

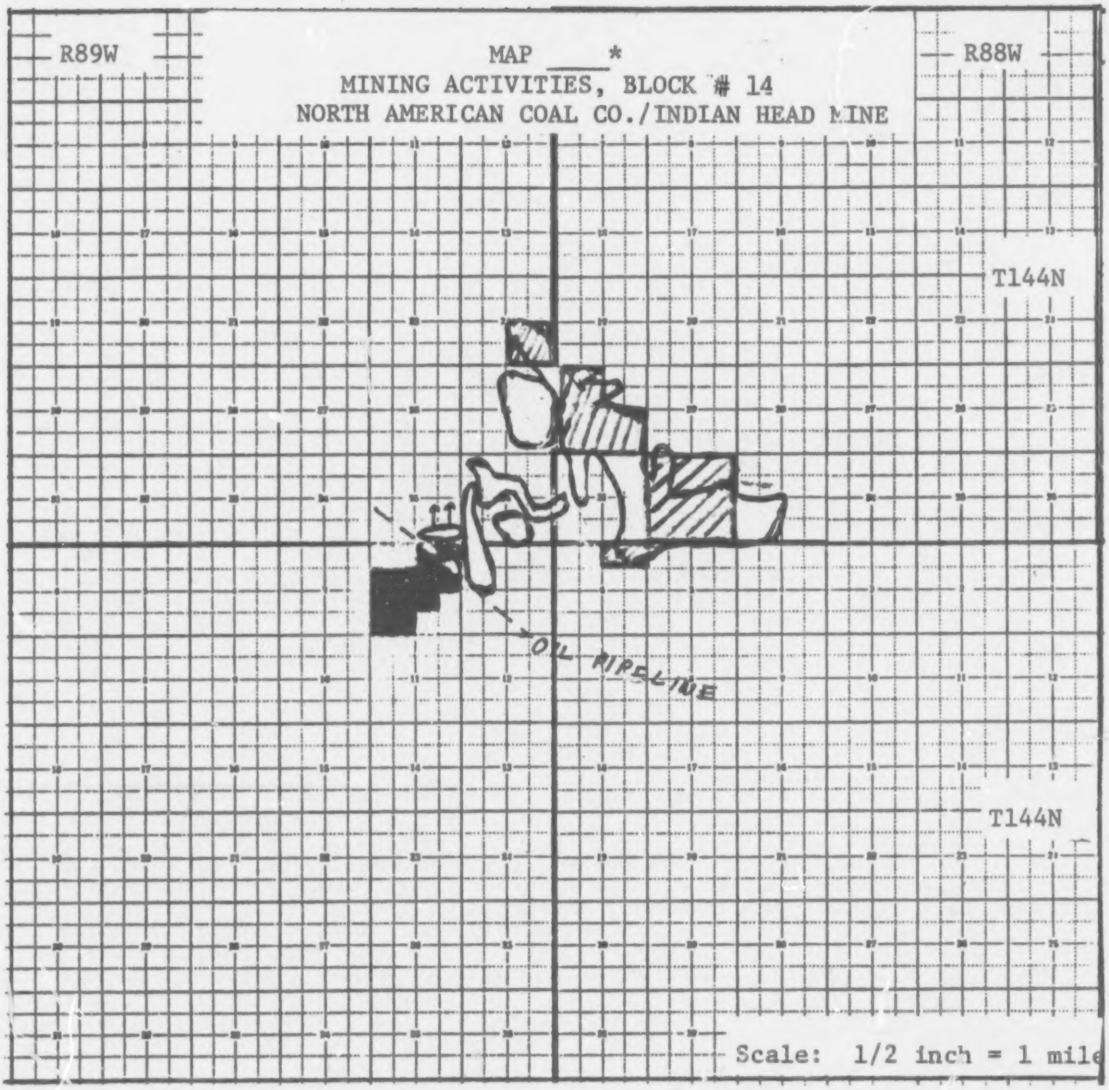
North American holds two federal leases within the Indian Head project area. One, Lease B-020273, was issued in 1922 and has been mined-out. In all, 11.9 million tons of lignite were extracted from the 1,300 acres of federal mineral lands. The second was granted at the end of 1979. North American has had to contend with a number of problems in attempting to initiate production activity at this site. Production from the lease area is limited by an oil pipeline that runs through the northeastern corner of the property and the cropline that cuts through the south and eastern sections of the site. While some recoverable federal lands were lost due to the buffer zone required around the pipeline, NACCO's biggest problem with the mining of federal coal has been its inability to obtain OSM's approval of the mine permit application. The federal lease, which NACCO planned to mine from south to north, is located directly south of the existing strip mine operation. The southern portion of the lease is an area of low overburden ratios while the northern section has high ratios, and the overburden reaches depths of up to 140 feet. Originally the company planned to mine the lease in conjunction with the pit opened directly north where the overburden is thickest along the southern portion of the operation. In this way, NACCO would have been able to mine reas of low overburden along the federal lease while extracting fee coal under deeper verburden. Later, NACCO planned to mine federal coal with high overburden ratios while oducing fee coal with low overburden ratios. The costs of the two mining operations ld have been averaged resulting in a selling price within NACCO's contract ceiling. hough the mine plan was approved during September, 1980, mining had already commenced the fee coal tract and NACCO's planned cost averaging sequence was thrown out of r. NACCO could no longer afford to recover both the federal coal with high urden and to mitigate an archeological site situated in this same area of high rden. The company is in the process of amending its approved mine plan ation.. and thereby reduce the amount of federal coal to be mined by 0.5 million North American plans to bypass the federal lease altogether if the amended plan pproved by both OSM and USGS in a timely manner.(7,8)


R89W
R88W
BK020273 1,357.44 Acres
T144N
M34980 440.96 Acres
Beulah
NORTHERN
BEULAH MUNICIPAL AIRPORT
MINE
Knife
STRIP MINE
LANDING STRIP
WEST
MERIDIAN
COUNTY
Block # 14 Approved
T143N
EMMAUS CEMETERY
(Block #12)
COUNTY
49
200
31
36

MAP ____

BLOCK #14 NORTH AMERICAN COAL CO./INDIAN HEAD MINE*

*See following map for detail of mining activities



MAP ___*
MINING ACTIVITIES, BLOCK # 14
NORTH AMERICAN COAL CO./INDIAN HEAD MINE

R89W
R88W
T144N
T144N
OIL PIPELINE

Scale: 1/2 inch = 1 mile

*Source: William B. Hansen
USGS, Billings,
Montana

Key

▨ Federal Lease BK020273

■ Federal Lease M34980

⬭ Mined Out

→ Direction of Advance

1. North American Coal Corporation, *Application for Surface Mining Permit--Indiana Head Mine*. Submitted to U.S. OSM, Denver, Colorado. December 21, 1979.
2. Ibid.
3. James Brown, North American Coal Corporation, Bismark, North Dakota. Interview comments, September 1980.
4. Gerald Groenwold, North Dakota Geological Survey. Telephone interview comments, September 1980.
5. Ed Englerth, North Dakota Public Service Commission. Interview comments, September 1980.
6. U.S. Department of the Interior, Bureau of Land Management. Land Use Analysis--North American Coal Company Coal Lease Application M-34980(ND).
7. William B. Hansen, U.S. Geological Survey, Billings, Montana. Interview comments, September 1980.
8. Ed Englerth, op. cit.